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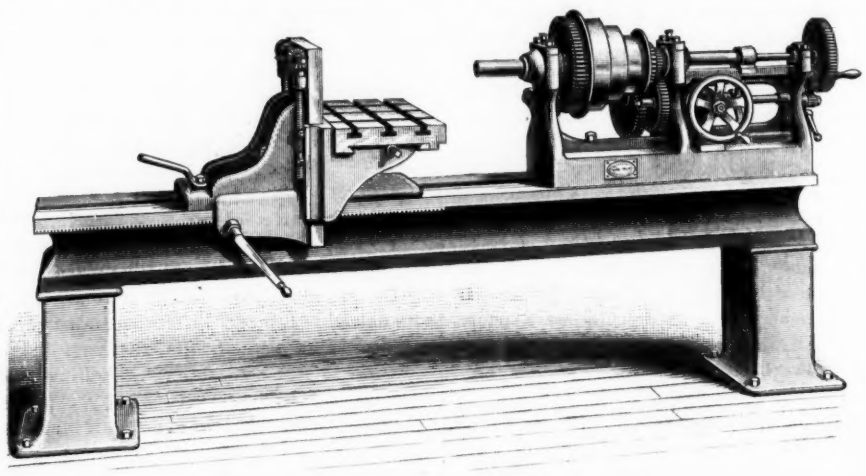
Horizontal Traverse Drilling Machine.

We illustrate on this page an improved machine for drilling and small boring, which we think possesses many advantages for the class of work it is intended to do.

As will be seen, the machine consists essentially of a bed resembling that of a lathe, on which is mounted a head fitted with a spindle which can be traversed in or out by hand or automatic feed motion, a distance of 12″, this motion being imparted to it by means of a screw at the rear, which works in a nut in the end of the spindle. This screw is turned by the handle shown in the gear for a quick motion, by the hand-wheel at the side for a slow motion, or driven by the feed mechanism for feeding.

The spindle is driven by the three-stepped cone and back gears shown, and slides through a sleeve which is fitted to the boxes. To the bed in front of the head is fitted an upright, which has a movement along the bed by a rack and pinion, and can be securely clamped in any desired position. Upon the face of the upright is fitted a knee which is moved up or down by two screws connected together in the same manner as those of a planer, and upon the upper face of this knee is fitted a platen, which can be moved forward or back by means of a screw. Work clamped to this platen can thus be operated upon, and holes bored or drilled at any point without loosening it from the platen. A hole is provided in the upright into which a bushing may be fitted for supporting the boring bar. It will be seen that where a number of holes are to be drilled or bored parallel to each other in the same piece, this machine gives good facilities for the work, and of course such fixtures as may be needed for any special work may readily be attached. The machine may also be used for end milling or sawing metals when desired. It is made by the Nicholson & Waterman Mfg. Co., Providence, R. I.



HORIZONTAL TRAVERSE DRILLING MACHINE.

At the Cincinnati meeting of the American Society of Mechanical Engineers there was a committee report on a standard method of testing pumping engines, the object being to formulate something that should be accepted by engineers, to the end that such tests should be more comparable, and that disputes between builder and purchaser should not occur as to the manner of getting at the performance of pumping engines. The report of the committee is quite exhaustive, and will come up for discussion at the Richmond meeting in November. The matter is considered an important one, and it is hoped that the society will, with this report as a basis, agree upon something that it will recommend; such a course would undoubtedly lead to more common practice in tests of pumping engines.

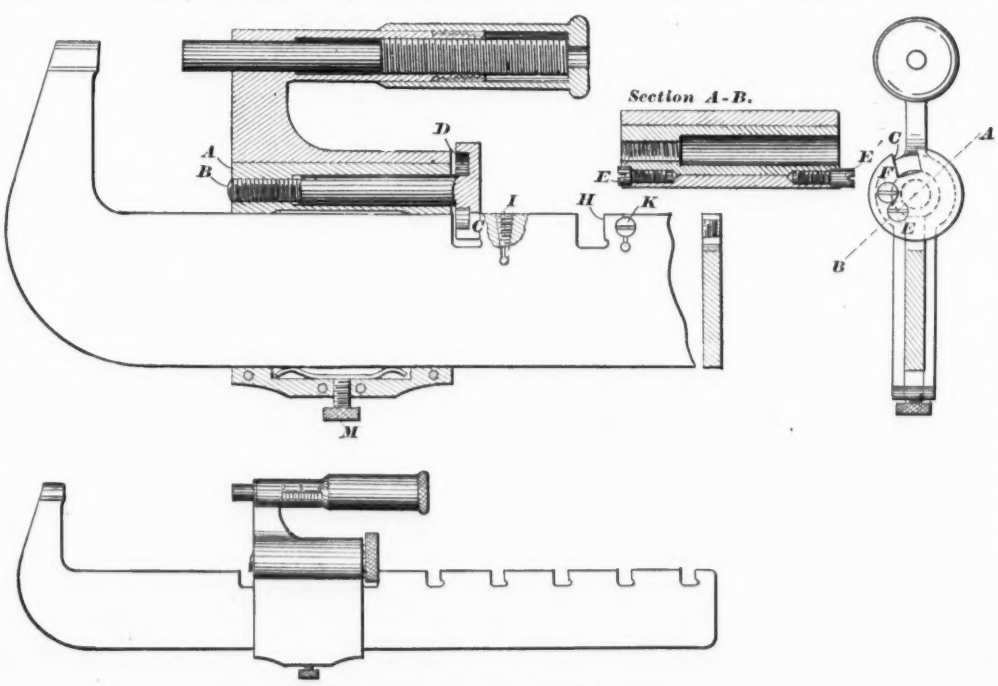
We have not hesitated to express the opinion that Chicago would make a success of the World's Fair. But there appears to be some danger that too much time will be given to words, reducing thereby the time for work. There is none too much time for preparation, and every one who hopes to see a great fair would feel easier if more work was being done.

A Proposed Micrometer Caliper.

BY A MECHANIC.

I believe there is no good extension micrometer caliper on the market. I undertake to show a plan of one which I think might answer the purpose. Some may offer a better one, so if my suggestion calls out a good one my time will not be wasted. The covered micrometer screw shown is patented, so if any one chooses to make such tools, it will only be necessary to design something which is not patented.

The idea is a micrometer screw with an inch motion as is usual, and a sliding jaw arranged to be located by notches in the bar one inch apart. The faces of notches *H* are to be ground accurately one inch apart, and the notched side of bar hardened.



PROPOSED MICROMETER CALIPER.

In section *A B* the adjusting screws *E E'* are shown. The screw *E'* to have the head extended to enter the recess in the head of screw *B*, and in connection with short screw *F* (tapped in the head of screw *B*) to make a stop, when jaw is properly located.

In moving jaw it will be necessary to first slacken screw *M*, then turn screw *B* in until the slot *C* corresponds with bar, then slide jaw where it is wanted, and turn screw *B* out a little, and press jaw back so the head of screw *B* shall come in contact with face of notch *H*, then turn screw *B* out until the stop screws *E'* and *F* come together and tighten screw *M*.

If it should be found impracticable to do in this way, adjusting screws like *K* or *I* can be used. I plan to make the sliding jaw a solid forging, except the inserted piece to receive the screw *M*, and the sleeve *A* with one side flattened to make the fit on the bar. A slot is cut through one side of the head of screw *B*, so that, when turned to match bar, the jaw can be moved.

The older crop of railroad shop mechanics will always remember the trouble frequently encountered in removing piston rods from crossheads; remember the hunting of wedges and their eventual failure to accomplish the desired result; remember the time put in on this altogether disagreeable job. Mechanical genius has, in later years, come to the rescue, until now there are devices made for this job that relegate improvised wedges and the ever-present sledge to other uses. It is a good thing that this is so. It saves a good many crossheads, and an occasional piston rod.

The Modern Steam Plant and its Management.

BY PETER H. BULLOCK.

MORE REGARDING THE TRANSMISSION OF POWER.

In my last paper some results were given that were obtained by making belts too tight for economical transmission; also from putting a length of shaft out of level, out of line, and with one bearing box too tight. These experiments were all with a 16-foot length of $1\frac{5}{16}$″ shaft, with three bearings, and when the center was pushed out of line, the outer ends being free to move, the shaft assumed the shape of a bow, or, as stated at the time, the shaft was bent in two places, while if the ends were held in place as when it was a part of a connected line, there would be four bends, the same as in a crank. In order to show the difference, I have taken the line of which the former shaft experimented with is a single length, and will try some every-day problems with it. There is an unused 20″ pulley on this shaft, and I will wind the cord for the weight around that, as the greater leverage will require less of the scrap-heap than when used directly on the shaft. There are several pulleys on this shaft, with belts running to countershafts in the before-mentioned primitive repair shop, and I will leave them all in place just as they are in daily use. Under these conditions it takes $29\frac{3}{16}$ pounds, suspended from the face of the 20″ pulley, to start the whole line of shaft, with the belts running as usual on eight loose pulleys. As in the former case, no less weight will start the shaft into motion, but when once started, the speed will increase until the weight reaches the floor.

I will now move the end bearing out of line $\frac{1}{4}$″, as this will be the nearest parallel to the former trial of any we can get, for when the end is pushed over, the shaft assumes the bow shape, but not so perfect as when both ends of the single length were free, and the center box pushed over. It now takes 31 pounds to move the shaft, which is pretty near the same per cent. of increase as in the former experiment. We will now put the end bearing back into line, and move a central bearing $\frac{1}{4}$″ to one side. As both ends of the shaft being moved are held in position by the rest of the line, this makes the four bends spoken of as being the same as a crank, and the difference between this and the end bearing being out of line will show the amount of power lost under the different conditions.

Now there is a pulley on this shaft right close to a bearing, and it carries a belt horizontally to a speed lathe countershaft, and this will be another good opportunity to show the loss from a too tight belt. We will now push the shaft in the direction that will loosen the belt. It now takes $33\frac{1}{16}$ pounds to move the shaft, so this is the increase due to the shaft being out of line anywhere except at the end box.

We will now move the shaft in the other direction to tighten the belt before spoken of. As this belt has to be kept pretty tight to do the variety of work the lathe is for, the $\frac{1}{2}$″ shorter it will be made by moving the shaft

$\frac{1}{4}$" away will make it that much too tight. It now takes $35\frac{7}{16}$ pounds, which increase over the last experiment must be wholly due to the belt, for the shaft was moved just the same amount in both directions.

Now I would like to try a piece of crooked shaft, but not wishing to sacrifice any of this in the cause of science, I will fix one of the couplings so it will have the same effect on the running of the shaft as if it was bent. This is done by loosening the bolts, and putting a washer between the face of the couplings on one side, and tightening up the bolts again. On trial it is found that it takes $34\frac{3}{8}$ pounds to move the shaft with this artificial crook. Owing to one of the bearings being near the doctored coupling, the motion is very uneven, and it seems to bind more in one position than in any other. I will now put on the driving belt, and let the shaft run at its regular speed while it is thus held out of truth. If the reader could only see this shaft running, without knowing the cause, I doubt not that he would say that the line was bent in several places, both sides of where the trouble is, for the bearing spoken of holds the shaft to place there, and using it as a fulcrum, the strain is transferred along the shaft, and shows in a very pronounced "wabble," both sides of the next bearing. This shows how easy it is to be mistaken, and how one may be deceived when judging from appearances that may be produced by entirely different causes.

In order to have all these results correct, so far as conditions are concerned, all of the experiments were made upon one length of shaft in a line, for iron varies greatly in quality, some lengths being hard and stiff, while others are elastic and easily sprung, and had the different experiments been made on shafts of various and unknown qualities, the figures obtained would not have been of much value for comparison.

Thus far in these experiments there has been but one bearing at a time thrown out of line, and in only one case has there been more than one cause operating at the same time to increase the power consumed in moving the shaft, and that was when it was sprung in a direction that tightened a belt, and the extra amount caused by this was very evident when compared with the result, when the shaft was moved an equal distance in the other direction. In order to see what the effect would be with more than one bearing out of line, I pulled over two in the same direction, and found that it then took $34\frac{3}{16}$ pounds to start it, or less than when but one was moved. This of course was due to the bends being on a longer curve. After this, four bearings were moved one-quarter of an inch in alternate opposite directions, when it required $40\frac{7}{16}$ pounds to start it, and it would not, as in the former trials, increase in speed very much as the weight descended. Similar effects are often seen where pulleys are located centrally between hangers, and tight belts spring light shafting much out of line.

In a recent case that came to my notice, two machines, using about ten horse-power apiece, were located so that both belts pulled in the same direction, and were so tight as to perceptibly spring the shaft, and it was recommended that one of the machines be moved to the opposite side of the room, so as to equalize the pull on the shaft. This was finally done, and the engine, a 30 horse-power that did little else besides running these machines, would then make over forty revolutions after the steam was shut off, while before the change was made it would not go over thirty. This was of course not a scientific test, neither was there one made, but the parties stated that they were sure they used less fuel than before, and I have no reason to doubt their estimate of over 5 per cent.

When two adjacent bearings are moved one-quarter of an inch in opposite directions it makes a bend of half an inch between the first and third and between the second and fourth bearing, and, to see what the difference would be if two bearings were moved one-half inch to one side, and the rest left in line, I proceeded to do this by moving bearings 1 and 3 one-half inch in the same direction, and then found that it took $42\frac{1}{16}$ pounds to start the shaft. In this case the strain on the two bearings moved, and the one between them was probably the same as when they were moved half as much in opposite directions, as the curve at these points would be the same, but the strain on the end bearings, that were not moved in either case, was of course double the amount it was when bearings 1 and 3 were moved but one-quarter of an inch.

When the two bearings were moved one-quarter of an inch in the same direction, there was a point in the shaft between them that was more than this out of line, and it occurred to me to try three bearings, moving the first one-quarter, the second one-half, and the third one-quarter of an inch in the same direction. This being done and trial made, it was found to take but $32\frac{1}{16}$ pounds to start the shaft, or less than when two bearings were moved a less distance than were the three in this case. In the latter trial the center of the curve, or fulcrum of the bend, was in the bearing that was moved the most, and the curve was a third longer than when but two bearings were moved, and the center of the curve unsupported, or between two bearings where it could vibrate.

From the above experiments we can learn that a shaft may be considerably out of line with a relative small loss of power, *provided* that the error is evenly distributed through several bearings. Yet, taking the least amount required to start the shaft, $29\frac{3}{16}$, as the unit, we find that three bearings thrown out so as to make an even bend increases the amount to $32\frac{1}{16}$ or 9+ per cent. for the most favorable error. It pays to keep the shaft in line. We can also see that crooked shafts or bearings out of line, that make short bends, consume more power than any other, and that such short bends, with the accompanying extra friction in the bearings, may be caused by the pull of belts, the same as by the bearings holding the shaft out of line.

All of these experiments have been made with comparatively small shafting, and, of course, the strain of bends, etc., is less than with larger sizes. It is also fair to say that the larger sizes are usually erected with more care than are the smaller ones, yet the much larger number of light sizes probably make the aggregate of power transmitted by them more than by those of larger size, as will also the fact that the same power is usually distributed to the machines by light shafting.

As we look over these unnecessary losses that may and do occur from lack of care or from improper original design, it should impress the fact on every person in charge of the production or transmission of power that it is quite possible for things to *run* and still be wasting power, that a little work directed by experience and common sense would quickly prevent. If the man in charge of the motive power does not have charge of the transmission and distribution of the same, somebody else must have, and these suggestions will be profitable for *him* to peruse.

One of the steel scroll saws at the Washington Gun Foundry recently cut through a piece of gun-carriage metal 4 inches in width by 5 inches in thickness in twenty minutes. The saw is of English make.—*N. Y. Times.*

It does not follow that just as good saws cannot be made in this country. But it is a fact that European mechanics are a long way ahead of Americans in the use of saws for cutting cold metal. Much work that is done by tedious methods here is done very quickly there by cold-sawing. This is one of the things that seems to hang fire in this country. A small amount of such work is done in America, but it amounts to practically nothing as compared to what is done in Europe.

A type of small boat known as the Beebe-McLellan boat has been recommended by Ensign Ackerman in a recent paper before the Naval Institute for general adoption as a lifeboat aboard ships of war. The boat is in the main the design of Lieut. C. H. McLellan, United States Revenue Marine, at present on duty in the life-saving service. The boat is now being supplied to life-saving stations.

Explosion from Unknown Causes.

By James C. Bayles.

(A Paper Read before the New York Meeting of Mining Engineers.)

The most unsatisfactory occurrences in the experience of a manufacturer are those from which he suffers damage and learns nothing useful. That there are such incidents, and that they occur with annoying frequency, is unfortunately true. An accident which can be understood and explained always carries some consolation with it. However bad the consequences, one finds comfort in reflecting that they might have been worse, and that the knowledge of how to avert a more disastrous calamity from the same cause is worth what it cost. But when an accident occurs which remains unexplained after anxious days of investigation and sleepless nights of reflection, and which is as liable to occur twice or twenty times as once, very little satisfaction of any kind can be extracted from it by the most philosophical victim. Three such incidents have come under my notice in one establishment. Fortunately, none of them was attended with very serious consequences, as no one was hurt and the damage to property was slight; but in each instance loss of life and great destruction were escaped by so narrow a margin as to make them extremely disquieting. I have recorded them in the hope that, from the experience of others, may be gained what my own careful investigations have failed to reach—satisfactory explanations.

The first of these curious occurrences was the bursting of a 16-inch pipe carrying air under a compression of about one pound. The pipe was made of light galvanized iron with soldered seams. Into it a rotary fan-blower delivered air, and from it smaller pipes were carried to the furnaces. The blower was run continuously. Neither the main pipe nor its branches had any connection with the gas conduits. Both air and gas pipes delivered into the furnaces; but although the gas was under much higher compression than the air, there appeared to be no good reason why, having free escape in case of leakage, it should ever make its way back into the air-pipe. One warm afternoon in June the main air-pipe exploded with great violence. Every window in the mill was blown out, a considerable section of the roof was raised an inch or two, and in several places it was blown through. The pipe was torn into a thousand pieces, and a wagon-load of fragments not larger than my hand were scattered all over the mill. Several of these fragments were driven edgewise into the roof timbers. The disk closing the end of the pipe was projected against a brick wall with such violence that it remained fastened in place, and is there yet, a mural tablet commemorating the event.

I promptly investigated the accident and learned the following facts: The pipe in which the explosion occurred extended the whole length of the mill. The machines then in use were placed together near the end connected with a blower, leaving some eighty feet of what may be called dead end. It was in this dead end that the explosion occurred. The portion of the pipe from which outlets were taken was substantially uninjured, but seventy-five feet of the eighty feet beyond the furthest outlet were utterly destroyed. The fact that, with very little mending, the part of the pipe which the explosion had not reached continued for some months to supply the machines with air, shows how local the explosion was, and the damage to the mill building gave sufficient evidence of its violence.

The natural explanation of this explosion is that gas found its way into the air-pipe and was packed away in the dead end, and that when mixed with air in explosive proportions it reached a furnace and exploded. I can only say that the most rigid investigation failed to explain how the gas got into the air-pipe against the pressure it carried, and why an explosion, beginning at a furnace, should have restricted its effects to the dead end of the air-pipe. It was undoubtedly a gas or vapor explosion, but I can find no other explanation of the presence of gas or vapor than that it was formed by the volatilization of the oil consumed in lubricating the trunnions of the blower. It is conceivable that the large amount of oil consumed by the blower is volatilized, and that it becomes a hydro-carbon gas, which would behave like any other gas of similar composition. This gas, being lighter than air, would occupy the upper part of the pipe, and remain undisturbed while air was drawn from outlets taken from its under side. This light gas may have worked along and accumulated in the dead end of the air-pipe until it reached, in admixture with air, the explosive condition. But whence the spark? And why, if fired by a furnace, was the destructive force of the explosion exerted so far from the point of ignition? This hypothesis assumes that the volatilized or gasified oil of many days' running would remain undiffused for as many nights, until its accumulated volume was great enough to explain the phenomena of the subsequent explosion. The best that can be said of it is that perhaps it is better than no theory at all.

Nothing similar has occurred since. We replaced the galvanized iron pipe with a sixteen-inch steel tube, 400 feet long, to meet the increased requirements of the establishment. All the other conditions remain the same, except that a small opening was left in the end of the pipe, which cannot be wholly closed. Whether this is necessary we do not know. The accident taught us nothing whatever, and, so far as we are aware, the same causes are now at work, and may at any time produce like results. The fact that no great damage was done is due to the frail character of the tube in which the explosion occurred. If the sixteen-inch steel tube should ever be destroyed with equal thoroughness by such an explosion as I have described, I hope I shall be in another State.

The second of the curious accidents I shall mention was the explosion of a No 6 Sturtevant blower. I was a witness of this amusing, though somewhat alarming, occurrence, and can speak of it from personal knowledge. The blower was inside the mill, and was driven by two belts from pulleys on the main line of shafting. It was used to furnish blast for the gas generators. Some trouble with the main driving belt necessitated a stoppage of the mill engine, and the blower stopped. In a few minutes the engine started again, and with it the blower. It had been long in use, but as this was its first day of service in that position I was naturally curious to see how it worked. So I stood watching it. Suddenly it disappeared. One side passed close to me and lodged against a post. Fragments weighing twenty to fifty pounds were distributed in all directions. The explosion was accompanied by a violent report, and succeeded by a dense cloud of yellow-brown, offensive smelling smoke, which rose to the roof, rolled right and left, and finally escaped at the monitor.

Again I investigated, until there remained no questions to ask. That it was not a centrifugal rupture I know without being told. The conclusion was that during the stoppage of the engine some air-gas from the producers had worked back through the pipe into the blower. When the blast was resumed, these products of imperfect combustion were carried with the air current into the producers, and being mingled in explosive proportions, had been fired by contact with the incandescent fuel and exploded. This explanation was never quite satisfactory to me. An explosion which began in the producer could only reach the blower through two branches of a tee, six feet of vertical pipe, an elbow, twenty-five feet of horizontal pipe underground, another elbow, six or eight feet of vertical pipe, another elbow, and four feet, more or less, of pipe connected with the outlet of the blower. Some of these pipes were light and some heavy, and the section underground was much larger than the section at either end of the run. If an explosion violent enough to wreck the blower completely had occurred through the whole length of this very circuitous pipe, I should have expected to find some evidence of it in the pipe itself. It was intact. Not a joint was started.

Furthermore, as the blower had been running at least four minutes immediately before the explosion, what could have remained in it to explode? The fact was, however, that the blower was shattered, while the pipe was undisturbed, even the delivery nozzle of the blower remaining coupled to the length of pipe on the mill floor, which was not thrown out of line. As in the first instance, this explosion taught us nothing.

The third of the series of unexplained accidents consisted of two explosions following one another so closely, and under conditions so nearly identical, that they may be considered as one episode. In the purification of gas we use purifying boxes of the usual pattern. We have four boxes so connected by the center seal that we can throw any one of the four out of use when it is necessary to clean it. The gas always passes through three boxes before reaching the gasometer, and one is always kept ready to be filled with fresh iron and brought into use when needed. When the gas shows the presence of impurities or diluents it is time for a change. To make the procedure clear, let us suppose the boxes to be numbered 1, 2, 3 and 4, and the gas to be passing through 1, 2 and 3 in the order stated. No. 1 would, of course, become foul first, as it first receives the gas. If a test of gas which has passed through No. 3 shows that it is not completely purified, No. 1 is cut out and No. 4 brought into use. The gas would then go through Nos. 2, 3 and 4 in the order stated, and No. 1 would be emptied and refilled in readiness to become the third of the series when the fouling of No. 2 made it necessary to pass the gas through Nos. 3, 4 and 1. In reality, the box to be brought into use is not refilled until it is needed, but otherwise the procedure is as I have described.

One day the superintendent and manager had occasion to go into the purifier house together, and while there the superintendent tried the gas. Getting a reaction indicating the presence of impurities, and finding the fourth or idle box ready, he turned the center seal, cutting out the box which had been the first to receive the gas, and making the clean box the last of the series. The cap of the outlet was left off for the escape of the air, and not screwed on until there was a strong smell of gas, indicating that the air had been expelled. The same thing had been done in the same way hundreds of times. In two or three minutes the third box exploded with great violence. The cover was wrenched loose from the four clamps holding it down; carried up through timbers and roof and dropped again, badly wrecked. The center seal was canted to one side, allowing a copious escape of gas. The building took fire, and a second explosion in the basement blew out about half the foundations. The second explosion was easily understood. Fortunately, fire extinguishers and hydraulic jacks saved the building, and except the need of repairing the broken box, the damage was slight. I at once began an investigation, which has lasted ever since. The explosion was undoubtedly due to the ignition of a mixture of gas and air in the box; but how was it ignited? The gas, before reaching the box in which the explosion occurred, had passed through the hydraulic main, two scrubbers, more than 500 feet of unjacketed pipe, and two purifying boxes, each containing three layers of wet sesquioxide of iron. It requires a violent stretch of the imagination to believe that a spark could travel so far under conditions so adverse. The pipe which delivers gas to the boxes is rarely quite cold, but I have never found it more than warm. The tops of the boxes are always cold, and the gas enters the gasometer at atmospheric temperature. While we were speculating as to the cause of this accident, and congratulating ourselves that it was never likely to happen again, another box, the third of the series in use, exploded under exactly similar conditions. A detailed account of one explosion describes the other perfectly.

Matters were getting serious. No one had been hurt, but it was not impossible that the thing would happen under conditions which could not fail to kill somebody. I must find out what was wrong and correct it. So I called in all the experts I could reach. Some were honest enough, after looking the plant over, to confess that they had no explanation to offer. Others gave reasons which would have been satisfactory had they not been at variance with the facts. For the information of those who may be disposed to speculate as to why these boxes exploded, I may say:

1. The hydraulic main is modeled after the best gas-works practice.
2. The scrubbers are adequately supplied with water.
3. The iron in the boxes which exploded was found, on analysis, to contain less than nine per cent. free sulphur, and is still in use.
4. The iron was adequately revived before being replaced, and did not heat in the boxes. After the explosions it was found to be cold.
5. The iron was sufficiently wet.
6. There was no fire in the purifier house, and "no smoking."

Since these two explosions, which occurred in April last, we have had no trouble. There has been no change in the arrangement of the gas plant, for we can discover no way to improve it.

It would have been a great satisfaction to have been able in these instances to follow the sage advice of Hotspur, and out of the nettle danger pluck the flower of safety. But our nettle crop does not seem to be of the flowering variety. If I had investigated less closely I might have reached satisfactory conclusions—perhaps of no more value, however, than the honest doubts I am now willing to confess.

The interference of the German Emperor to reconstruct the Berlin fire department recalls a story told a few years ago by one of the professors in Columbia College. While studying in Berlin, a fire broke out in his *pension*, and one of his fellow students turned on the alarm. When the fire department arrived, the stately director came angrily into the house, stormed at the proprietress because a "first-class alarm" had been turned on for only a "third-class fire," and immediately ordered back his engine to its station. The proper third-class alarm was then given, and the third-class engine and corps arrived after the fire had been put out by his fellow students. It turned out that a first-class alarm was only to be given in case of a fire in a government building, theatre or church. The official who had these fires in his charge would not submit to the indignity of extinguishing a possible conflagration, so long as it was confined to the rooms of a boarding-house.—*Commercial Advertiser.*

The object of the most persistent invention continues to be the car coupler. Within a month over thirty new car couplers have been patented, and most of them are of such shape that no sane railroad man would think of risking them as an attachment to his cars. There is an idea abroad that a great fortune can be made out of a successful car coupler. This may be the case, but it will be difficult for any inventor or company to make half the money on a car coupler that has been spent on the invention of worthless devices. —*National Car and Locomotive Builder.*

The Dutch Indian Government offers a prize of 10,000 florins for the best practical answer to the question—In what manner should the salt which is sold in Dutch India in small packets be packed up so as to keep dry? Probably if some lucky inventor could devise a way for doing this he could patent it and make fifty times as much money. These government offers for inventions are a big thing—in a small way.

Scientists say that nature produces the light given by the firefly at about one four-hundredth part of the cost of the energy which is expended in the candle flame, and at an insignificant fraction of the cost of electric light, or the most economical light which has yet been devised.

It is said that the railroad industry of the United States furnishes a living to one in twenty-two of the population.

Odontics, or the Theory and Practice of the Teeth of Gears.

By Geo. B. Grant.

FIFTEENTH PAPER.

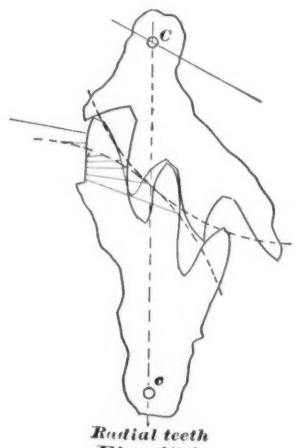
145.—IRREGULAR TEETH.

It is most convenient to draw all the teeth alike, with the same rolling circle, or from the same base line, and also to uniformly space the pitch line, but such uniformity is not essential.

The only requirement is that each tooth curve shall be conjugate to the tooth curve that it works with, and if that condition is satisfied the teeth may be of all sorts and sizes.

146.—FAILURE IN THE TOOTH ACTION.

When the major axes are in line the action of the teeth on each other is nearly direct, but when the minor axes are in line the action is more oblique, as shown by Fig. 127. The



Radial teeth
Fig. 131.

teeth tend to jam together when the driver is pushing the follower, and to pull apart when the follower is being pulled, and when the ellipse is very flat this tendency is so great that the teeth fail to act serviceably.

At first glance it might appear that this difficulty in the tooth action of very eccentric gears might be overcome by making the teeth radial to the focus, as shown by Fig. 131,

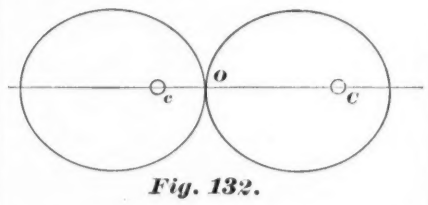


Fig. 132.

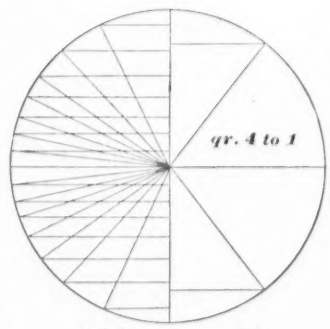
but examination will show that but little can be gained in that way.

The teeth on the gear C were obtained by the method of (28) from the assumed tooth on the gear c, and the effect of the defective shape of one side of the assumed tooth was to cut away the conjugate curve of the derived tooth.

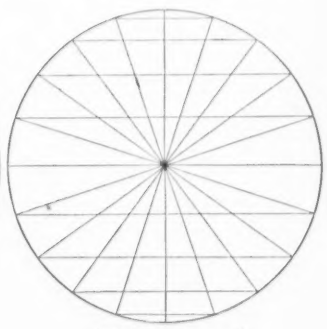
Such teeth would not work as well as the ordinary form, and their construction would be very difficult.

147.—THE LINK.

When the teeth of the elliptic gear fail to properly engage, on account of the obliquity of the action, the difficulty can be entirely overcome by connecting the free foci by a link (141), as shown by Fig. 127.



Quick return crank
Fig. 134.



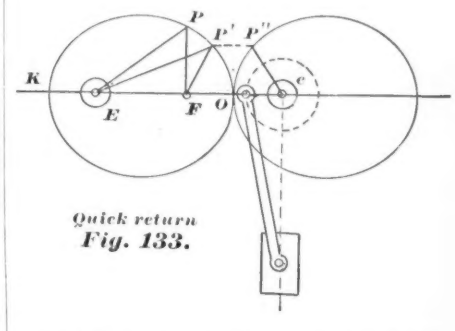
Ordinary crank
Fig. 135.

This link works to the best advantage when the teeth are working at the worst, and when it fails to act, as it passes the centers, the teeth are working at their best. Therefore gears that are connected by a link need teeth only at the major apices.

When the tooth action is imperfect by reason of its obliquity, and the link is not available or desirable, the difficulty can be overcome by using three or more gears in a train, as shown by Fig. 137, for then the same result can be obtained by the use of gears that are much more nearly circular.

148.—VARIABLE SPEED AND POWER.

If the shaft c, Fig. 132, turns uniformly, the slowest speed of the shaft C will occur



Quick return
Fig. 133.

when the gears are in the position of the figure, and the proportion between the two speeds will be the proportion between the distances cO and CO. The greatest speed of the driven shaft will occur when the shafts have turned through a half revolution from the position of the figure, and the relative speed will be the same, reversed.

The ratio of speed, the ratio of the greatest speed to the slowest speed, is the square of the ratio between the speed of the driving shaft and the greatest or the least speed of the driven shaft, so that it requires but a slight variation of the axes to produce a decided variation of the speed.

The following table will give the proportion of minor to major axes that will give any desired ratio of speeds.

Ratio of Speeds.	Ratio of Axes.
2	.985
3	.962
4	.952
5	.924
6	.907
7	.892
8	.878
9	.868
10	.854
11	.844
12	.834
13	.824
14	.817
15	.807
16	.800

The power is always inversely poprortional to the speed. If the variable shaft is running twice as fast as the uniform shaft, it will exert but one-half the force.

When the gears are arranged in a train, as in Fig. 137, the speed ratio for the second, third, and following gears will be in the proportion of the first, second, third and following powers of the first ratio.

Thus, the ratio for a pair of gears with axes in the proportion of .952 to 1 being 4 for the second gear, will be 16 for the third gear, 64 for the fourth gear, and so on.

The use of gears of troublesome eccentricity can be avoided by this means. A train of three gears of .952 axes, Fig. 137, is equivalent to a single pair of very flat gears with .800 axes, Fig. 138, and, in general, three gears that are nearly circular are equivalent to a single very flat pair.

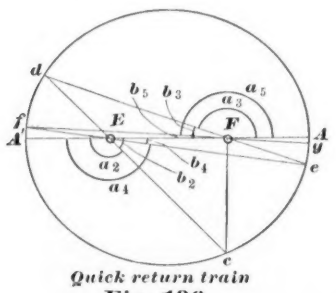
149.—ELLIPTIC QUICK RETURN MOTION.

If the gears are arranged with respect to the piece to be reciprocated, in the manner shown by Fig. 133, the time of the cutting stroke will be to the time of the return stroke, as the angle PEK is to the angle PEF, where E and F are the foci of the ellipse.

The following table will show the ratio of axes that must be adopted to produce a required ratio of stroke to return.

Quick Return.	Ratio of Axes.
2 to 1	.964
3 to 1	.910
4 to 1	.861
5 to 1	.817
6 to 1	.778

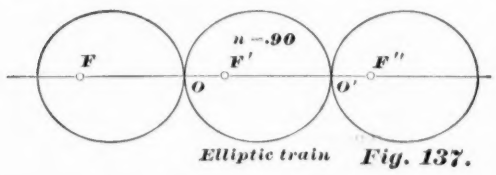
To determine the ellipse that will give a required quick return, we lay off the angles *PEK* and *PEF* in the given proportion, and then find by trial a point *P* such that the length *PE* plus the length of the perpendicular *PF* is equal to the known center distance *Ee*. *F* will be the other focus of the required ellipse.



Quick return train
Fig. 136.

When the driving gear has turned through the angle *P'EF*, from the position of the figure at the middle of the return, the variable gear will have turned through the angle $P'eO = P'FO$, and we can study the action of the tool by drawing equi-distant radii about *E*, and finding the corresponding radii about *F*.

Fig. 134 shows the arrangement of the radii ($P'F = P'e$ of Fig. 133) in the case of a four to one quick return, and it is seen, by the parallel lines, that the motion of the tool is very uniform, coming quickly to its maximum speed, and holding a quite uniform speed until near the end of the stroke. Fig. 135 shows that the same motion derived from a simple crank is not as uniform.



Elliptic train ***Fig. 137.***

When the gears are arranged in a train, Fig. 137, the quick return ratios can be determined by the construction shown by Fig. 136. Draw *Fe* at right angles to *AA'*, and draw *cEd* through the other focus. The quick return ratio of the second gear will be the ratio of the angles a_2 and b_2. Draw *dFe*, and the ratio for the third gear will be that of the angles a_3 and b_3. Draw *eEf*,

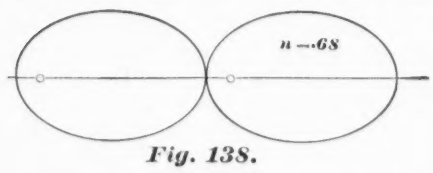


Fig. 138.

and a_4 and b_4 will give the ratio for the fourth gear. And so on, in the same manner, as far as desired, the ratio being greatly increased by each gear that is added to the train.

If carefully performed, the graphical process is quite accurate. The case of axes in the proportion of .98 to 1 gave a quick return of 1.6 for the second gear, and 2.8 for the third gear, while their true computed values are 1.66 and 2.74.

The chart will solve quick return train questions involving gears not flatter than .90, as accurately as need be. For example, the ratio of axes of .95 will give a quick return of 2.25 for the second gear, 4.85 for the third gear, 9.80 for the fourth gear, and 19.70 for the fifth gear. Again, the proportion of axes to give a quick return of 5 for the third gear is .948.

150. — THE ELLIPTIC GEAR CUTTING MACHINE.

The conditions of the described operation of drawing the ellipse by means of the trammel (138) may be reversed, the bar being held still while the paper and the cross are revolved, and it is evident that the result will be the same ellipse on the paper as if the bar is revolved as described.

By thus reversing the process of describing the ellipse, and by adopting the improved spacing device of (142), we can construct a machine for accurately cutting the teeth in an elliptic gear, the main features of which, omitting various unessential details, are shown by Figs. 139 and 140.

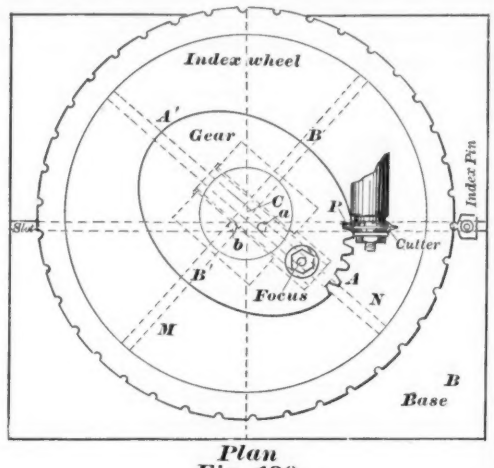
The blank to be cut is fastened upon a trammel stand, which corresponds to the paper in the graphical process, and revolves upon the fixed base. The adjustable trammel pins *a* and *b* are fixed in a slot in the bed, and they fit and slide in the slots *M* and *N* in the under surface of the stand. The cutter which corresponds to the tracing point is fixed with the pitch center of its tooth curve directly over the point *P* in the line of the pins. The index plate has a diameter equal to the sum of the axes of the ellipse, and it is held by an index pin *p*, which slides in the slot, and is always in the line of the pins.

Thus arranged, the machine will always cut its tooth in the true ellipse, and the teeth will be accurately spaced.

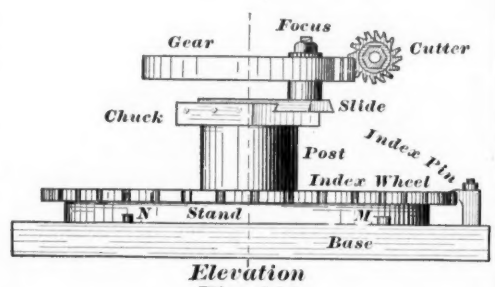
The direction of the tooth will be substantially at right angles to the pitch line, and a simple arrangement can be applied to make it exactly so. An index plate of a fixed diameter may be used for all sizes of gears, if the index pin is carried by an arm which swings about the center of the gear, and has an adjustable pin that slides in the slot.

The tops of the teeth are trued by a cutter having a square edge, and the line of the tops will be substantially parallel to the pitch line.

The blank is held by an arbor through its focus hole, and the arbor is held by a slide, which slides in a chuck upon the stand, so that the focus can be accurately set in the major axis at the proper distance from the center.



Plan
Fig. 139.



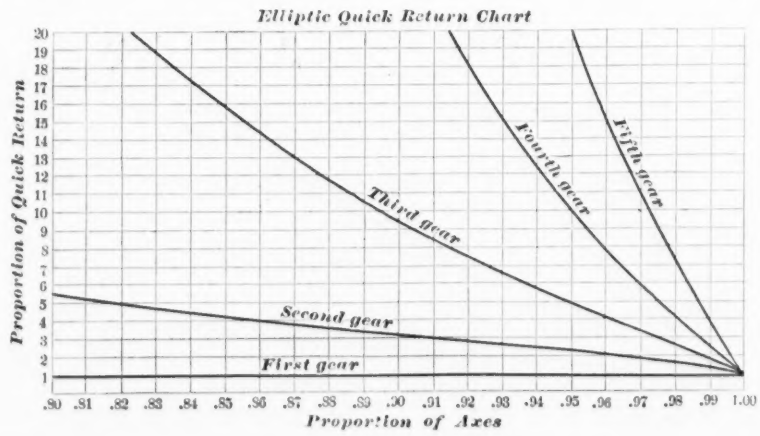
Elevation
Fig. 140.

151.—CHOICE OF CUTTERS.

Theoretically, the teeth are of different shapes, as they are in different positions upon the ellipse, and, therefore, each space should be cut with a cutter that is shaped for that particular space. But as this is impracticable, it is necessary to choose the cutter that will serve the best on the average.

Strictly, the cutter should be the one that is fitted to cut a spur gear having a pitch radius equal to the radius of curvature of the ellipse at the major apex, but as that cutter will be much too rounding for the minor apex, it is better to choose the one that is fitted for the medium radius of curvature.

The two radii of curvature are the distances *Ch* and *Ck*, Fig. 122, and the cutter should be chosen for the radius half way between the two, approximately half the sum of the two.



152.—THE ELLIPTIC BEVEL GEAR.

An ellipse may be drawn on the surface of a sphere by means of a string and two pins, according to the method of (138), and a pair of such spherical ellipses will roll on each other while fixed on their foci, their free foci moving at a constant distance apart.

Therefore we can have elliptic bevel gears that are very similar to elliptic spur gears, as shown by Fig. 141. The two gears revolve on radial shafts through their foci, and the link connects radial shafts through the free foci. The velocity ratio is the ratio of the perpendiculars *a b* and *a c*. The elliptic bevel gear is the invention of Professor MacCord.

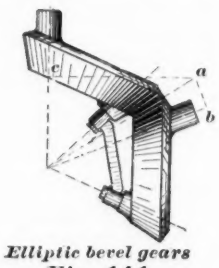
The spherical ellipse cannot be drawn by the trammel method of (138), and therefore the method of spacing of (142), as well as the gear cutting machine of (150), does not apply.

153.—MATHEMATICAL TREATMENT.

If the major semi-axis is *a*, and the minor semi-axis is *b*, the equation of the curve from the origin at *C* is

$$a^2 y^2 + b^2 x^2 = a^2 b^2,$$

the major axis being the axis of *X*.



Elliptic bevel gears
Fig. 141.

The distance *CF* from the center to the focus will be

$$c = \sqrt{a^2 - b^2} = a\sqrt{1 - n^2},$$

in which *n* is the ratio of axes $= \frac{b}{a}$.

The radius of curvature at the major apex is $\frac{b^2}{a}$, and that at the minor apex is $\frac{a^2}{b}$.

There is no practicable formula for the rectification of the curve, as the length is expressible only by a series.

The special spacing method of (142) is true only at the instant of passing either apex, for the tracing point describes half the arc described by the line of the bar on the index circle only when the bar is at right angles with the curve. The error will be at its maximum when the bar is at the maximum angle with the normal, which is at about an angle of forty-five degrees with the major axis. The difference between an ordinary tooth space at the major apex, and that at the minor apex, is very minute. A very careful calculation of the length of the chord of a gear of seventy-two teeth, and eight and ten inch axes, gave a chord of .41433″ at the major apex, a chord of .41495″ at 45° for the maximum, and a chord of .41441″ at the minor apex. The difference between the chords at the apices is .00008″, but as the curvature at the major apex is greater than at the minor apex, the difference between the arcs would be less, perhaps not over .00004″.

The ratio of speeds (148), is

$$\left(\frac{1 + \sqrt{1 - n^2}}{1 - \sqrt{1 - n^2}}\right)^2$$

The ratio of quick return being given as *qr*, the value of *n* is

$$n = \sqrt{2\sqrt{d^2 + d^4} - 2d^2},$$

in which $d = tan.\ \left(\frac{180}{qr + 1}\right)^\circ$.

When the gears are in a train, there seems to be no simple method for computing the ratio of axes to produce a given quick return, but, when the ratio is given, the quick return for each gear can be computed best by trial and error with the formula

$$\frac{sin.\ (M - N)}{sin.\ M + sin.\ N} = \sqrt{1 - n^2}$$

in which *M* is any known angle *b*, Fig. 136, and *N* is the angle *b* for the next following gear in the train. Thus, assuming $n = .98$, and $M_1 = 90°$, we find $N_2 = 67° 28'$. Then putting $M_2 = 67° 28'$, we find $N_3 = 48° 5'$.

Knowing the angles, we compute the quick return ratio from

$$qr = \frac{180}{N} - 1,$$

which, for $n = .98$ gives *qr* for two gears equal to 1.66, and for three gears equal to 2.74. The graphical process of Fig. 136 should first be employed to fix the angles approximately.

Preventable Accidents.

Those who keep run of the events of the day must have been painfully impressed with the great number of railroad wrecks that have occurred during the past few weeks, and the long list of fatalities that has attended them. In five of these disasters about sixty lives were lost, or an average of twelve to each disaster, and as many maimed for life. This is a disheartening record, and it will do much to still further lessen the confidence of the traveling public in the carefulness and efficiency of railroad management.

The fact, however, which will impress people the most unfavorably, is the acknowledgment that all these disasters were preventable. In each and every case they were due to the carelessness of one or more employes of the railroads. The wreck on the Old Colony road, with its score and more of victims, was directly traceable to slipshod methods in track repairing. The responsibility for the disaster on the Reading Railroad at Shoemakersville can probably be divided between the company's system of running coal trains close together, and the heedlessness of a brakeman. The killing of four and the injuring of eight persons in Chicago, ten days ago, are charged by the coroner's jury to the "gross negligence" of the employes on the two colliding trains.

But, bad as these three disasters appear to be, they do not exhibit that criminal carelessness which was seen in the wreck which occurred near Newark, O., last Sunday, and by which eight persons were killed. A heedless telegraph operator was so absorbed in novel reading that he forgot to obey a dispatch to side-track a freight until it was too late, and then, realizing the nature of his criminal blunder, he wired for a wrecking train to go the spot where he calculated the disaster must occur, and disappeared. Still

a fifth wreck, which caused the death of three trainmen near Mauch Chunk, Monday evening, was the result of the failure of the day operator to call the attention of the night operator to an order just received before the former gave way to the latter.

Here are five accidents with fifty-nine deaths, every one of which was preventable. In each case the railroad company on whose line the disaster occurred must share the blame with the culpable employes. These wrecks are directly traceable to loose methods in management, and the employment of incompetent hands. The two telegraph operators who are responsible for the Newark and Mauch Chunk wrecks were both too young to be trusted with such duties. There should be no hesitation in calling the men and the companies answerable for these disasters to a strict account. They are crimes, and not accidents, and should be treated as such. The public, which trusts its life to the care of these railroads, has the right to demand that the highest skill and the most extreme care should be exercised in their operation and management.—*Philadelphia Press.*

Catalogue File.

We present on this page engravings showing a piece of office furniture devised by a manufacturing firm for the purpose of systematically keeping and classifying trade catalogues. In their business it has been found to work entirely satisfactorily, and a description of it may be interesting to others who have experienced the annoyance attending the keeping and efforts to refer to, catalogues, when kept in the ordinary way.

This cabinet consists of a case of antique oak well finished, and made so tight as to effectually exclude dust. In this case are one or more shelves, according to size of case, and to these shelves are fitted light movable partitions of iron. These partitions are fixed to a rod which runs along the front of the shelf, and fit into a perforated strip which is let into it at the back, so that by lifting the partition at the back, as shown by Fig. 1, it may be moved along to any position, and when dropped into the metal strip at the back is firmly secured in place. Thus the space between the partitions can be apportioned between the different letters of the alphabet as may be desired, and every inch of space fully occupied. The letters are fixed to the outer edge of the partitions, as shown, and the space between two adjacent partitions may be occupied by two letters, or there may be as many partitions as there are letters.

In connection with the file, provision is made for the use of a card index by which catalogues are indexed by subjects as well as by proper names, so that not only can any desired catalogue be instantly found by the name of the firm issuing it, but a collection of catalogues in which any given article is described can be readily made at any time, which will include all that has been received on that subject. This index is arranged at the left of the cabinet, as shown in Fig. 3, the cards which have the index letters upon them being higher than the others, of which latter there may be as many as may be desired in any division. The two kinds of cards used are illustrated in Fig. 2, where two entries have been made under the letter *C*, the design being to leave sufficient space under each entry, to not only write all the names of manufacturers of the given article, but notes relating to discounts offered from time to time, and by whom, together with such other information as may be useful. It is thus seen that what is often more of an annoyance than anything else, is reduced to a system by which the minimum of time is consumed with the best possible results.

It has been found by experience that a full line of catalogues, systematically kept, often becomes one of the most valuable and highly prized adjuncts of a business office.

The cases are made to be adapted to any business, or to catalogues of any size, and may contain as many shelves as may be desired, or be of single or double width. They are made by Sam'l C. Tatum & Co., Cincinnati, Ohio.

Petty Boss Makers.

By Pedro.

"A Mechanic," in the American Machinist of August 21, touches a subject in his last two paragraphs which prompts me to say a few words on the same question. Not that I care to discuss "petty bosses" at this time, but simply relate a few of the maneuverings of a petty boss maker. The "petty boss" is certainly fortunate in being thrust into a position over his fellow workers in the same department, inasmuch as it gives him opportunities which will prove to his advantage if he knows enough to use them properly, provided that the duties of the position are such as can command the respect of a conscientious and decent young man.

A. was a conscientious, hard-working, and an excellent mechanic, who had been working in a certain manufacturing concern for seven years. The management in A.'s department consisted of a foreman, B., and an assistant, C. D. was the "super." of the entire concern.

A time came when B. resigned his position as head man, and left the concern. Assistant C. was promoted to head man, and A. was, after a while, appointed as his assistant.

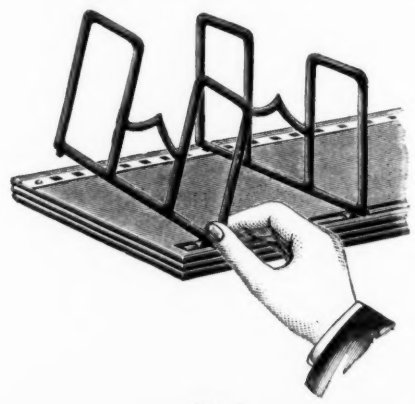


Fig 1.

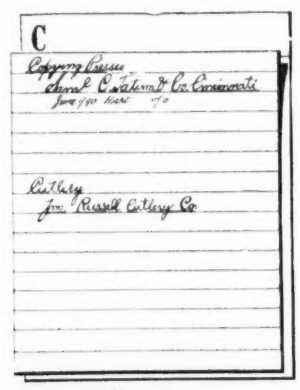
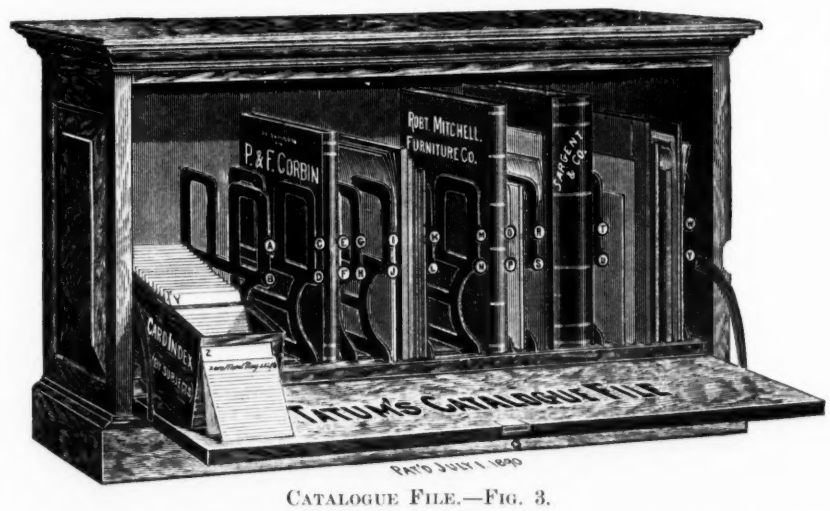


Fig. 2.



Catalogue File.—Fig. 3.

Now, C. was A.'s junior by a number of years, and his inferior in many respects, but A. knew that it was his business to obey the orders of his "superior," or "get out." Not wishing to do the latter, he patiently did the former to the best of his knowledge.

C. soon grew in disfavor with the foremen of the other departments of the concern, on account of his bulldozing propensity. They avoided him as much as possible, and transacted their business with the assistant, A., whenever they could find an opportunity to do so. Such opportunities frequently presented themselves, for C. was seldom in his place when wanted. Things ran on in this way for about a year, when another change was inaugurated by "super." D. No one knew anything of the proposed change until one Monday morning after A. was called to "super." D.'s office. A. was there told that C.'s management of affairs was not satisfactory, and that it had been decided to put E. into his place. Now, E. was an apprentice who had served somewhat over two years of his time—possibly three years.

In breaking this information to A., D. evidently had pre-concluded that A. would think that he ought to have the place, and thought that, owing to the disappointment, he might leave the concern. To prevent being snubbed in that manner he introduced the subject very cautiously, and in a much round-about way, talking about the eight-hour day, what effect it would have upon the works if introduced, etc., etc. He told A. that things had become very much demoralized under C., but that he hoped to restore order under the new management, and that he would like to have A. remain with them. After he was through with his long-winded harangue he wanted to know of A. what he thought of it, and what he expected to do. To this A. replied that he could not answer that question upon such short notice, and that he would like to have a day or two to think the matter over. D. told him that he could have all the time he wanted.

After this conference A. returned to his post of duty, and about an hour later D. appeared upon the battle-ground to formally install E. as general of eighteen men, more or less. He summoned the men, and did up the business in the form of a speech, in which he said that C. was sick a great deal of the time and unable to attend to business. A. says this was a lie to start with. Then D. proceeded to state that the business had become much demoralized, and in effect charged the whole body of men as dishonest shirks who could not be depended upon to attend to their business without having a detective to spot every man who dared to leave his place without permission. To enforce this dictum, D. stated that E. would henceforth have charge, and that he (D.) would be his backer. These were not the exact words he used, but it is a fair statement of the effect produced.

This harangue set A.'s mind to revolving at the rate of about 3,000 revolutions per minute, but he managed to successfully resist the centrifugal force from bursting it, otherwise there might have been some lively gyrations on the part of D. After the speed had run down somewhat A. asked himself, "Can it be possible that D. blames me for the disorder which he claims exists? I have always attended to my part of the business according to the wishes of the foreman, C. Nobody has ever told me that I was not doing as desired. I have always tried to give satisfaction to my employers, and any difference could easily have been adjusted by simply mentioning the same to me. I will find out what he means; I will ask him point blank."

A. did not get an opportunity to ask him until the next day. When confronted with the question, D. replied that he instructed C. repeatedly in regard to the matter, and that if he could not keep order it was A.'s business to do so.

"But," said A., "was I not under C.'s orders? If I comply with his orders is not that the end of my responsibility? If my doings were not satisfactory to *you*, why did you not come to me and tell me so?" To this he had nothing to say, except to repeat that he told C., and therefore A. should be held responsible. Such an excuse, of course, is too silly for even a child to offer. A. insisted that it was D.'s business to come to him, and not to C., and state his grievances if he thought he had any against him. Again he endeavored to cloak himself by saying that, as "super.," it was his business to treat with the foremen, and not with the men. This statement might have had some weight had it not been for the fact that he advanced A.'s pay while he was a workman under B., and this, too, without B.'s knowledge. Also, while A. was C.'s assistant, "super.," D. frequently gave orders to A. in C.'s absence, for work to be done, and in the face of all this he had the imbecility to tell A. that it was not "proper" for him to treat with any one but the foremen.

The "disorder" which D. claimed to exist was a little conversation occasionally between some of the men that did not relate strictly to business.

Now the bottom facts of the case were these: D. had a hobby to ride, and that hobby was to put "petty bosses" (as "A Mechanic" calls them in the paper above referred to) in charge of the various departments of the concern. A good mechanic will not take charge unless he is paid in proportion to the responsibility, but a young man, barely out of his apprenticeship, will take the place for small pay when he is assured that he will be backed by the "super." Then, if a good mechanic can be bulldozed into working under such management, he also will be secured at small pay, because he would not feel justified in asking as much in the capacity of a workman as in that of foreman.

As a general rule, only two classes of men can be obtained under this bulldozing system. The one is an incompetent, low grade of workmen, and the other may be good mechanics, who are compelled to submit to the bulldozing on account of some conditions or circumstances over which they have no control. The unscrupulous "super." is always on the alert to take advantage of such cases. This sifting of good, independent men, from these two classes began, in the case above cited, as soon as E. was mustered in as chief. The assistant, A., was the first one to give in his notice, and left a few days later. Others soon followed.

The above shows that "super." D. had to do some lying in order to get into the saddle of his hobby-horse. This is always the prerequisite in such cases. D. gives "lectures" once in a long while to classes in drawing, in which he has been known to dwell at some length upon moral lessons in regard to truthfulness—that "it pays" to always tell the truth, and how hideous was the liar! He evidently does not believe in practicing what he preaches, except when it seems to be to his personal benefit in favoring his hobby.

The action of D. in this case, in setting himself up as prosecutor, judge and jury, at the same time, trying his subject, A, on *ex-parte* evidence, and passing sentence upon his victim in his absence, and without his knowledge of the proceedings, represents the method of procedure in too many cases. I think that right here is where more "labor troubles" originate than from any other cause.

When A. told D. that his services with the concern would end the following Saturday, D. replied, "You are making a mistake, and you will regret it." A. has done so much better in every respect since he took that step that he has been "kicking himself" ever since for not having left the concern years before when he had good opportunities.

It is said that more than usual efforts are being made to provide for entertaining the mechanical engineers at the Richmond meeting.

The Japanese as Metal Workers.

The Japanese are past masters in the treatment of alloys both in texture and color, and no better guides exist. They achieve their grand results by the simplest means—a judicious blending of various metals, inlaying and pickling. Copper is the basis of their chief alloys, and by incorporating with it certain proportions of gold and silver they obtain remarkable results in color through the pickling process.

But not only do they get striking effects from their alloys and pickling—their mode of working up the metals is a thing to be studied. For instance, they will take six or seven plates of different metals and alloys, weld them together, and then by drilling, punching up and filing, get a surface in which all the metals show in a manner which is truly wonderful. By the range of tints at their command they can work out on a metal surface scenes of animal life, landscapes, etc., with effect never dreamt of by metal workers in the western world. Among some examples recently shown in England was a knife-handle on which was a representation of a duck dipping its head under the water of a stream on which it was swimming, the arrangement of the different alloys by which it was composed, and the pickling being so well arranged that the neck of the duck was seen as under the water when the handle was held in a certain light. Another example was a sword-hilt on which some minnows, not more than one-sixteenth of an inch in length, and each having a pair of gold eyes, were swimming up a gray stream, the effect of their being actually below the surface of the water being suggested with marvelous skill. Imitations of wood grain and marbles were also shown.—*Jewelers' Review.*

LETTERS FROM PRACTICAL MEN.

Swivel Head Lathes.

Editor American Machinist:

There seems to be quite an interest taken for and against the swiveling head lathe. I wish to offer my testimony for the swivel head, as I believe it to be of great value.

Mr. Conradson says that it is impossible to make a swiveling head stop without greatly complicating the feed mechanism, without gaining any compensating advantages therefrom. Can it be that he never saw a Gage swiveling head lathe? I must believe he has not, or he would not make that statement. In the shop in which I work there is one of these lathes that has been in constant use for eighteen years, and has always given the best of satisfaction. The feed, instead of being complicated, is exceedingly simple, and has several advantages over the feed mechanism of ordinary lathes, especially in screw cutting. The spindle has but one motion in either right or left-hand screw cutting, the feed can be instantly stopped, while the spindle is kept running, allowing the operator to use the file, an advantage that any mechanic will easily recognize. In ordinary lathes it is necessary, in cutting threads on studs, bolts, etc., to return them to the lathe to chamfer the ends, especially when there is a number to cut. This may be done on a Gage swiveling head lathe, with the side of the thread tool, before the work is removed from the centers, which will make quite a saving in time. I wish to show that this lathe (sizes of journals, wearing surfaces, etc., being equal) is just as good for any purpose as any other lathe made, while it has the advantage of boring a tapering hole at a moment's notice, and can be set straight again in another minute. The head-stock is made with a base, which carries the feed mechanism, and on which the head-stock swivels; the base is bolted to the shears in the usual manner. The power is conveyed from the spindle, on which is a miter gear, which connects with another miter gear on a vertical stud, which passes down through the head-stock, at a point just back of the front upright to the feed gears underneath. A recess is bored at this point in the base, and a lug on the head-stock, through which the vertical stud passes, is turned to fit in the recess, making the swiveling mechanism.

Upon the arrival of this lathe in the shop, an "old jour." suggested the idea of putting a tapering pin through the head-stock into the base, and of graduating the end, which is finished in a circle, whose center is the center of swivel. This idea was acted upon at once. The head-stock was removed from the bed, and placed on an arbor, and taken to the gear cutter and graduated in degrees; it was then put back in position and placed in perfect alignment, a hole bored by hand and reamed tapering, and a pin with a square head to remove it with was fitted to the hole. The head-stock is bolted to the base through slots, into tapped holes in the base.

You will readily see that, when it is desirable to bore a tapering hole, it is only necessary to slacken the bolts, remove the pin, swing the head in the desired position, and screw down the bolts again, and the head-stock is just as rigid as on any lathe that the head-stock and bed are not cast in one piece.

In adjusting the lathe again to bore a straight hole, it is only necessary to slacken the bolts, swing the head in line, insert the tapering pin, and rap it down gently, screw down the bolts, and it must be right every time.

Now it seems to me that any mechanic can see that it does not take an "astronomer" to place this head-stock in alignment, and that even a "greasy mechanic" can set it straight with his eyes shut. I am not selling the Gage lathe, nor interested in the sale of it in any manner, and only use this to show that swiveling head lathes can be built, that will do any work that any lathe can do (except special lathes), and also bore tapering holes.

Because all lathes are not made swivel heads is no sign that they are not reliable. It costs considerable more to build them, and I think that is the reason they are not more in use.

GEO. W. CLARKE.

Plating Steel with Nickel.

Editor American Machinist:

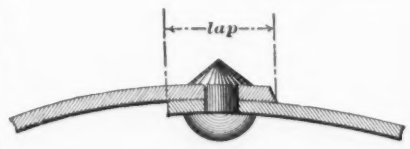
Referring to Question 366, current volume, nickel will not adhere to steel as readily as to cast-iron or brass. Steel being a finer or closer metal, there is not the same chance for the nickel to hold itself in place by filling the slight imperfections, hence it is more likely to "peel off" as it is usually termed.

I took a piece of hardened steel, a piece of annealed steel, a piece of cast-iron, and a piece of brass, and put them in the same solution, and used the same current. I left them in twenty minutes. The cast-iron and brass were well plated, but the nickel did not "stick" well to the steel.

If you take a pair of common scissors with a cutting edge of steel and malleable iron back and handles, and plate them, you will find the nickel will adhere firmly to the malleable iron, and peel from the steel. The close grain of the steel makes the operation analogous to the operations of painting wood and painting iron. In the first case the paint will fill the open spaces of the wood, and this will hold the body of paint on the surface. But the paint does not so readily "catch on" to the slighter defects in the surface of the iron, and hence more precautions must be taken to get on a coat that will stay.

This, it seems to me, indicates the reason why nickel, and probably copper, does not cling to steel so readily as to other metals.

SABIN HAWLEY.



Riveted Joints.

Editor American Machinist:

In reading the excellent article in your issue of October 2d on riveted joints, it occurred to me that your quotation from Wilson's Steam Boilers might be misleading, as I have found the opinion very common that lap is the distance from center of rivet to edge of plate.

The quotation referred to is: "The lap for single riveting should be equal to three times the diameter of the rivet, and never more than 3.3 times the diameter."

Then you refer to the ordinary practical rule which is to make the distance from center line of rivets to edge of plate equal to $1\frac{1}{2}$ times the diameter of rivet.

With a wrong idea of lap it might be inferred from this that Mr. Wilson's rule was twice as large as that used in practice; but if we regard the lap to be as shown in the sketch, we see that the two are identical. In the treatise referred to (American edition) it will be seen (page 332) that: "A margin (or net distance from outside of holes to edge of plate) equal to the diameter of the drilled hole has been found sufficient in all cases." If we consider that the diameter of hole is about $\frac{1}{16}''$ larger than diameter of rivet when cold, we see that this conforms with your recommendation to make distance from center line of rivets to edge of plate equal to $1\frac{5}{8}$ times the diameter of rivets. For a three-quarter inch rivet, a good average size, this gives in the one case $1\frac{5}{8}\times\frac{3}{4}'' = 1.21875''$, and in the other $1\frac{1}{2}\times(\frac{3}{4}''+\frac{1}{16}'') = 1.21875''$.

J. J. FLATHER.

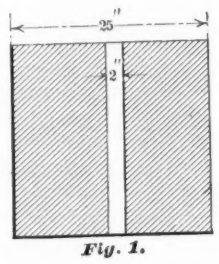


Fig. 1.

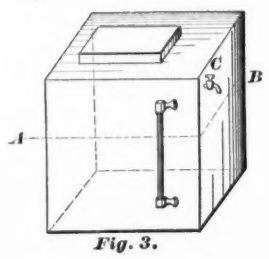


Fig. 3.

Porosity of Bricks.

Editor American Machinist:

Mr. Bullock is of opinion that I have laid too much stress upon the effect of porosity of bricks. Now I don't want to see a man like Mr. Bullock take this view of the matter, because he is too good an engineer to have against one, and therefore I want him to look at the matter on a basis derived from his own figures. Therefore I will take the case of the brick he has experimented with, and which he finds contains eight per cent. of pores. Well, eight per cent. of porosity simply means that if the brick were compressible we could crush it into $\frac{92}{100}$ths of its present volume, leaving $\frac{8}{100}$ths of unoccupied space.

In Fig. 1 is a square having a side of 25 units. Across this square I have drawn a band of two units in breadth, and the area of this narrow band is therefore just eight per cent. of the area of the square. It represents, in fact, the ratio of the face of a brick which Mr. Bullock states is occupied by pores. It is practically equal to 12 square inches on every square foot of wall area, and, apart from the resistance due to the flow of air through fine pores, we may take it that if we build a wall with glazed bricks, having each a hole of $1\frac{1}{2}$ square in the middle of it, we have a representation of the surface of the eight per cent. brick. Taking the case of a full-sized Lancashire boiler with side flues of five feet in height, the total side wall area of a single boiler standing alone and not in battery is about 300 feet. Of this the porosity is represented by a hole about five feet square. If we were to smooth down a brick wall of 300 feet area to a true plane, and then slice off a veneer say $\frac{1}{250}$ths of an inch thick, we could pass through such a thin sheet of brick an enormous amount of air, though not so much as would pass through a five-foot square hole in a glazed brick surface. As we keep increasing the thickness of our veneer sheet to nine inches, we keep adding to the resistance it is true; but the fact that a brick set in one-eighth inch depth of water will become wet through, is a proof that the eight per cent. of cavity space is all in connection, and that there is a clear way through every brick, even for water, and still more so for air, though the way is long and by fine passages. Still the way is there, and it is a clear way, though infinitely tortuous, and I feel sure that with the common bricks of boiler seatings, extra dry too, and with not the best of joints, an enormous amount of air must penetrate under a pressure of one-half inch of water (or even more in some cases). The waste thus brought about is constant, and though apparently trivial mounts up in the course of a year to something more than the cost of a pail or two of pitch.

Experience convinces me that economy in steam using is very largely due to care over trifles rather than one big economy. Some years ago I had the pleasure of the acquaintance of the engineer of a works employing about 900 I. H. P. Twenty years before, when this man first started at this place he found about 450 I. H. P. at work, and a coal consumption of about eight pounds per H. P. As load was added to the old engines so he reduced the fuel bill until, at the time I knew him, he had doubled his horse-power out of the same engines and halved the coal tonnage. This man had no high-class modern plant. He had six old boilers carrying 60 pounds gauge pressure only. He had a pair of large, slow-running beam engines taking steam from a pair of H. P. horizontals, and an old Boulton and Watt pair of marine side lever engines drawing steam from a pair of H. P. verticals, a truly patched-up arrangement altogether, and yet with this plant he would, during two months of the year (March and September), burn only 2.23 pounds per I. H. P., including what was used for sizing and boiling purposes. This man was great on vacuum. He could start after the midday stoppage of an hour with a vacuum of 12 pounds still remaining in the condenser. It was from him I first learned the value of the paint-pot on injection pipes, and with all his good results he had none but common slide valves, no rapid cut-off gears, no high speed, no high pressure, and nothing but slack coal.

Tarring injection pipes is undoubtedly a good plan, for cast-iron is undoubtedly porous in common pipes, especially at faulty chaplets, and where runners are broken off; but I never said tar the *inside* of injection pipes. I referred to the outside, which I would tar when the vacuum was inside, if a vacuum can be said to be anywhere. By this the pores would be better filled. Properly speaking, pipes should be heated and immersed in a proper mixture. Half an inch extra vacuum is certainly worth securing, and this I have known got in France by tarring a long pipe.

A man who gets charge of a high-class Corliss engine is often apt to think he has got all that is necessary to cheap running; but in this he is much out. Given high speeds and pressures, and a very little carelessness, and away goes your steam, past the piston, round a bit of worn valve edge, and in pours air at stuffing-box glands and fifty little pin-holes, and an extra six or eight ounces of coal per H. P. is gone at once to join another ounce or two that is warming up air that comes through eight per cent. bricks. Experiments on porosity may be thus carried out. Cement a brick into a hole cut in a tin vessel, as in Fig. 3—this vessel, being open below and fitted with a gauge glass to indicate the water level, etc., inside it. Dip the vessel into water up to the level *A B*. Then the air inside the vessel will prevent the water rising inside so high as it does outside.

Watch now the gauge glass; the rise of the water in this is a measure of the amount of air passing through the brick. A half brick may be used to lengthen the time, and the larger the vessel the longer the period of duration. A tap at *C* may be used to quickly let out a little air.

Try the same, including a mortar joint; try a good brick and one of a coarse nature, and then paint the same and try again, and then count the bricks on a boiler setting, and next morning go round by the gas works and buy such tar as you may want for the

first coat, but don't experiment with wet bricks; see they are baked first.

As regards the porosity of a condenser, it is not a question of "losing" the vacuum, as this is usually understood, which I take means a total loss of vacuum; it is the loss for ten hours out of 313 days in the year of that little ⅛, ¼ or ½ inch on the mercury gauge, which, added to other unconsidered losses, makes up the difference between an economical engine and a wasteful one or less economical. The little may make all the difference to a man in charge. The steam user who has made up his mind he ought not to burn 1,000 tons annually will look very differently upon a record of 1,003 tons from what he would on 997 tons, but, as we all know, it is generally an easy matter to knock off 40 or 30 per cent. from the consumption of a badly attended engine, but when we have done this, and begin to strive after 45 or 33 per cent., we have to expend thought and care in an inverse ratio.

"We are now doing easily with three boilers what formerly was difficult to do with four," is a testimonial to the effect of advising by mail on indicator cards from engines one has never seen, which, while very pleasant to receive, convey really less credit to the consulting engineer than a three per cent. saving resulting from a whole day's working inspection. Any one can figure for himself the horse-power of one-quarter of a pound vacuum on his engine. For a 40-inch piston at 600 feet per minute it means fully 5¼ horse-power with a two-pound engine; this means 10½ pounds of coal hourly, or practically 100 pounds a day. With coal at $5 the ton this is equal to $75 per annum, or seven per cent. upon the engineer's wages in many cases, not to mention less boiler incrustation, fewer ashes, and, perhaps, just the last straw which makes all the difference between a fireman keeping things going and tidy and being run off his feet.

I never see an engine registering less than 14 pounds of vacuum when it has a good injection supply, but what I begin to wonder where the loss comes in. Yet, plain as all this is, it is most difficult to get men to see that a 12-pound vacuum is not good enough, that a bare steam pipe is a grievous fault, bare grate surface and thin fires a gross waste of fuel. There is fifty times the energy expended in getting a sharp, cut-off corner to a diagram than would effect many times over the same economy if directed to keeping things warm and tight. W. H. Booth.

Approximate Indexing.

Editor American Machinist:

I gave you a description (July 17, 1890,) of how I cut a 61 gear, and Mr. J. V. Hamilton, in your issue of August 14, tells how he got a much nearer approximation by setting the index for a *fractional number of teeth*. Acting on Mr. H.'s idea, I have computed the nearest approximations to all the numbers between 50 and 100 that cannot be cut on the B. & S. milling machine, either in the regular way or by the differential method, and present herewith a table of the same, with their corresponding moves, and the error in position of the last space cut for one diametral pitch.

Number of teeth.	Moves.	Error for 1 diametral pitch.	Order of cutting.
50.9986	$\frac{4}{15} + \frac{19}{31}$	.0044	Consecutively.
53.0001	$6\frac{13}{21} - \frac{5}{49}$	.0003	Every 9th tooth.
57.0022	$\frac{21}{39} + \frac{8}{19}$	.0070	Consecutively.
59 0015	$\frac{35}{39} - \frac{4}{31}$	.0046	"
60.9999	$4\frac{3}{15} - \frac{5}{47}$	.0003	Every 6th tooth.
62.9994	$5\frac{14}{33} - \frac{1}{28}$	.0019	" 8th "
67.0012	$2\frac{17}{35} - \frac{21}{29}$	.0035	" 3d "
70.9998	$3\frac{24}{35} - \frac{1}{23}$	.0003	" 6th "
72.9992	$3\frac{27}{35} - \frac{1}{45}$	.0022	" 6th "
78.9978	$\frac{34}{39} - \frac{4}{31}$	.0069	Consecutively.
80.9995	$1\frac{19}{39} - \frac{1}{23}$	.0016	Every other tooth.
83.0020	$1\frac{23}{39} - \frac{2}{47}$	.0063	Consecutively.
88.9968	$\frac{35}{39} - \frac{1}{19}$	.0094	"
96.9997	$2\frac{25}{35} + \frac{1}{31}$	.0009	Every 7th tooth.

Hence, the figures in the column marked "error" will have to be divided by the diametral pitch of the gear under consideration, and this result distributed up around the circumference as best it may. For instance, if we wish to cut a gear of 63 teeth of 20 diametral pitch, the error in position of the last space cut would be .0001", which might safely be neglected. If we wished to cut 89 teeth of 6 diametral pitch, the error in the last cut would be about .0015", to correct which we might move the cross-slide .0005" after every 30 teeth. I find, on looking over my July 17 letter, that I have made a misstatement in regard to the direction of the cross-slide movement, and take this occasion to correct it. It should read: If the index-head is set for a lower number than the desired one, the top of blank and the cross-slide must move in opposite directions, while if the head is set for a higher number, then the top of blank must move in the same direction as the cross-slide—that is, in making the divisions 51, 61, 63, 71, 73, 79, 81, 89 and 97, the top of blank and cross-slide must move in opposite directions, while with the divisions 53, 57, 59, 67 and 83 the top of blank and cross-slide must move in the same direction. Mr. Hamilton's method applies equally well, of course, to all numbers, but I only tabulated those below 100, so as not to absorb too much of your valuable space. Walter Gribben.

Hardening Steel to Prevent Cracking.

Editor American Machinist:

In your issue of Oct. 2d I notice a correspondent asks for information concerning hardening steel so that it will not crack. I give you my successful experience of nearly forty years: Have a tub of cold soft water and one of whale oil placed side by side. Heat the steel in a well-charred fire (charcoal preferred), until it becomes a bright cherry-red, then plunge it into the water until it hardens the outside, which will take from one to three minutes, according to size of steel. Quickly change to the oil, and let it remain until cold. This completes the hardening.

To temper, first clean it with emery paper, then place it on a bright fire without blast, turning it often until the proper color is obtained. W. A. Patrick.

Lime and Water for Marking on Blue Prints.

Editor American Machinist:

Regarding the use of lime and water for marking on blue prints, as advocated by one of your correspondents, I can add the following:

Some six or eight years ago I found that, after our machine shop had been whitewashed, the blue prints that were being used in the shop at the time were spotted more or less, and it occurred to me that the whitewash had done it.

I accordingly took some unslacked lime, and put it with some water in a small bottle, and after shaking it up well, I tried it with an ordinary pen, and found that it made a perfectly white line, and also that it worked satisfactorily in a drawing pen.

It has been used in our drawing-room ever since, and I can recommend it as a cheap and very satisfactory preparation.

William Wright.

That High Rotative Speed.

Editor American Machinist:

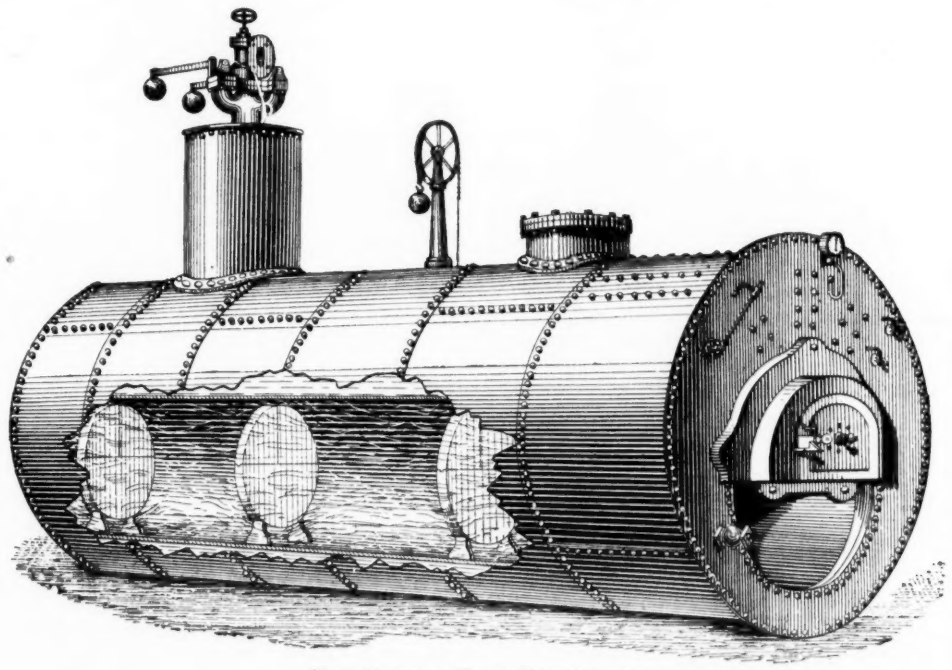
Answering Mr. Booth in this matter, I would say that the speed of "first shaft" was counted with a speed indicator in the usual way. The apparatus was mounted on a strong bench so near to the little engine, that I held the indicator in one hand and governed the throttle with the other. (The governor belt was thrown off.) The question of utility of such high speed, "even experimentally," I would place on a par with the utility of sitting in the sun or rain to watch base ball games during afternoons, weeks and seasons. It pays the one who does it by amusing him. C. C. Hill.

[We have on hand a large number of letters relating to the use of the divining rod for finding water. But, as nothing profitable is likely to come of their publication, we feel constrained to omit them.]

The Gosling Fuel Economizer.

We illustrate on this page a device which is being introduced in England for bringing about increased economy in the consumption of fuel in the furnaces of steam boilers. It is adapted for Cornish, Lancashire, or any boiler with horizontal flues.

The improvement consists of a number of disks which are placed at intervals in the flue, as shown by the engraving. The disks are made in sections, to facilitate putting them in place, and also to allow for expansion and contraction. The lower portions and the supporting brackets are of cast-iron, while the upper portions are of special fire-clay, the sections being grooved into each other, so that it is an easy matter to put them in or to remove them for cleaning or inspection. The number of disks used depends upon the length of the flue, and they are so placed that the space left for the passage of the gases is larger at the bottom than at the top. For instance, in a case where the space at the top would be two or three inches, at the bottom it would be eight or nine inches.



The Gosling Fuel Economizer.

The disks act to force the heated gases into contact with the flue entirely around its circumference, and thus extract the heat from them to the greatest possible extent, and the disks, becoming highly heated, serve to secure more perfect combustion than is at times otherwise possible. It has been found by trial that flues are more evenly worn about their circumferences where the disks are used; that a saving of fuel is effected, and that there is less smoke, while the boilers usually steam more freely and more uniformly than before they are put in. The disks are supplied by Robt. Gosling & Co., Hadleigh, Suffolk, England.

The American Institute Fair has been formally opened, and will remain open until November 29.

Sketches of an Apprenticeship.

By W. S. Rogers.

VI.

That old-fashioned drill press we had was a wonder in its time. The back gears were away up near the ceiling; the feed was operated by a hand-wheel almost as large as the fly-wheel of the engine, and having its bored hub threaded and fitting the threaded sleeve on the spindle. One could get an immense leverage on the drill with very little effort. Besides this, it made no difference where the operator was, he could always reach the feed. There was no quick-return, automatic stop, power feed and figures cast all over the frame telling us how fast the belt ran, what size drill to use, and just how many minutes it would take to drill each hole. Neither these nor any of the other many fancy jim-cracks that are on some of the modern tools of to-day. But it was a good, stout machine, that would put a good, true hole in any piece of work that was placed under it, provided, of course, that the person working it furnished the brains. And it had one redeeming feature that is lacking in some of the later machines—the wrench that was chained to its column fitted every bolt and nut on the machine. It was a monkey-wrench. Every other appliance pertaining to work on that machine was kept in the tool-room, except the pinch-bar we used for elevating and lowering the table.

That pinch bar reminds me of another experience. A bright, wide-awake boy that I knew, once upon a time, got a place as apprentice in a shop where a special type of machinery was built. This cub was ambitious to learn, and please his employer in every way possible. In erecting, and after completion of each machine, a crow-bar was always used to adjust it to its various positions. One day a machine was being shipped. It was loaded on the dray, the counter-shaft and smaller parts, including wrenches, neatly crated and boxed, were also loaded and the team started, when this young cub came rushing out in the street calling upon the driver to stop, and carrying the old shop crow-bar. Upon the proprietor's inquiry as to the cause of his racket, he earnestly explained that they "had forgotten to send the crow-bar along, so the other fellows could work it." It is needless to say that those machines were promptly "improved" so as to avoid the use of the bar.

Such incidents as this have led me to believe that one can better improve the machines and methods under his control and ownership by closely studying the ways of his employes and seeing their ideas expressed in actions, than he ever can by years of gilt-edged theoretical arguments developed in either office or drawing-room. The most valued improvements in machinery of the present day have been developed from ideas gathered from the actions of apprentices who are trying to get to the top.

A Nicaragua dispatch says: "The City of Paris, the second of the large Slavin dredges purchased by the Nicaragua Canal Construction Company, arrived at San Juan del Norte (Greytown) yesterday, and entered the harbor by the new channel.

"There is now nine feet of water over the bar, and the channel is steadily deepening by the natural action of the currents only. The steamer River Mersey, which towed the City of Paris from Colon, also brought as cargo 600 tons more of tools, machinery and supplies. The other one of the three largest dredges, the City of New York, will leave Colon for San Juan del Norte within a day or two. Her towing steamer is at that place awaiting her readiness.

"The Construction Company has now in its employ, and at work, a force of about 1,500 men. The general health of the employes continues excellent."

Californians are congratulating themselves over the performances of the San Francisco.

AMERICAN MACHINIST

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, OCTOBER 16, 1890.

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American Steel in Europe.

It is a fact of some interest to mechanics that American steel of the finer grades is gradually gaining a foothold in the markets of Europe; one or two manufacturers here having for some years sold considerable quantities there, and it is now announced that Park Brothers & Co., of Pittsburgh, will establish agencies in European steel markets, and compete for a share of the trade on the finer and higher priced steel. The fact that freight charges on low-priced steel would amount to a very large proportion of the total cost of placing such steel in European markets, is probably the chief reason why only the finer grades are expected to find a market there, though in this connection it is interesting to observe that experience shows that, as the point is approached at which competition in a certain line of goods is possible in European markets for American producers, it is almost always possible with the finest grades of that product before it is possible with the commoner grades, if ever. This is due in part to freight charges, which, being based upon weight, are of course a larger proportion of the cost of the commonner goods; but analysis shows that it is also due in part to the superior efficiency of our comparatively high-priced labor. Generally speaking (for of course there are exceptions), it is found that, taking the proportion of the total cost of a product, which is paid for skilled and high-priced labor, the greater that proportion is, the better can the finished product compete in foreign markets, while in cases where a large proportion of the total cost is for crude materials, and little or nothing for skilled labor, such competition is usually impossible. These are facts which American mechanics—and employers of American mechanics as well—will do well to give attention to. Of themselves they constitute no argument that any employer of American skilled mechanics should pay more than the ruling prices; but they do show that it is to the interest of all that the ruling prices should be high.

English Capital.

It is announced that the sale of the Roach shipyards to an English syndicate, which has been talked of for some time, has been consummated, the company which made the purchase having been organized, and nearly all the stock owned, in England. Thus another well-known institution passes into English hands, and we cannot help wondering where this movement is to stop, and how many of our "American industries" will be English industries before it does stop. It would seem as though it would be a good thing if less American capital were invested in Western farm mortgages, and more in manufacturing establishments. Of course, nobody expects the movement of capital to be controlled by what may be considered best for countries or communities. It will be invested where the best returns are to be had, security and convenience considered. But it is a question if American capitalists have not neglected opportunities for good investments in industrial enterprises, which have been taken advantage of by others. This is due in great measure probably to laws which require various trust institutions, savings banks, insurance companies, etc., to invest their funds in real estate mortgages, municipal, State, or government bonds. As we have before stated, we do not believe that the investment of English or any other foreign capital in American industrial establishments is a good thing for this country; for we do not see how it can be a good thing to have matters so arranged that our exports of things produced by American labor shall be paid for by dividends or profits made by other American labor, assisted by American enterprise and business management. If foreign investments here were sufficient so that the profits on them would pay for all our surplus of farm products exported, we do not see how America could accumulate wealth very fast. It seems to us we should simply be working for our board and clothes, so to speak, while the surplus produced would go abroad and we would get no return for it. We shall hope that American investors may be brought to perceive that it would be a good thing all round were they to see to it that well-managed manufacturing concerns here are supplied with all the capital required for the full development of their business, and if it were supplied in such a way as it is being supplied by the Englishmen, instead of simply loaned at a high rate of interest, which must be paid regardless of profits on the business, such investments would be found to give every reasonable security.

A sensational account comes from Chicago regarding the formation there of a company which is to build air ships of aluminum, by which aerial navigation is to be as easy as steamboat or railway traveling is now, and much more rapid. The telegram is more interesting as showing how easily the newspapers are induced to publish, as important pieces of news, the most ridiculous and absurd stories.

We think it is not improbable that aerial navigation may some time become an assured fact, and can readily see that the invention of a successful air ship would be a great thing for its inventor, and for humanity. But when such a ship is invented we shall not first hear of it as being perfected and controlled by a stock company with "twenty millions of dollars in solid cash paid in." Our readers may as well make up their minds to receive their American Machinists by means of the mails carried upon ordinary trains for some time yet, and to suffer the pangs of seasickness when they, with their families, go to Europe to spend the summer months.

From time to time during the past year or so items have appeared in the newspapers telling of the purchase of oil territory in Ohio by the Standard Oil Company, its purchases being so extensive, and made under such circumstances, as to show plainly that the intention was to enlarge upon its plan of controlling the oil refining business, and also control the production of the crude oil. The "Standard" recently reduced its quotations for crude petroleum from 37½ cents per barrel to 35 cents without apparent cause, other than a desire to bring about such a reduction ultimately as to make business unprofitable for its competitors. And as regards its ability to do this, it is pointed out that this company now owns or controls about two-thirds of all the oil-producing territory of Ohio, and by virtue of such ownership can dominate the business, and, after its competitors have been frozen out, dictate terms to manufacturing and domestic users of petroleum products. Its only competitors will then be the coal interests, and there monopoly reigns supreme.

What was once considered a luxury has, in hundreds of instances, come to be a necessity. This is particularly the case with ice. In this semi-northern part of the world ice has for years been considered necessary during the summer months. But now it has come to be almost a necessity during the colder season. The majority of houses as built today are constructed with the idea that ice shall be a necessity almost as great in winter as in summer. Along with this appears the fact that the natural ice crop grows more and more uncertain year by year. This year, for example, the stock of ice is so nearly used up that it is evident that a good many people must go without it this winter.

What is wanted is that mechanical ice-making shall relieve nature. Nature does excellent work if she has the proper conditions for the purpose, including proper material with which to work. But this is not always the case. On the whole, manufactured ice is the only solution of the problem of giving the people what they want of the necessity at a reasonable cost.

There is now in progress an effort to establish a gigantic "Shipping Trust" that shall embrace the entire British empire. The object of the federation appears to be to fight trades unions in an organized manner, when it appears advisable to fight. The plan proposes a central office in London, with subordinate offices at outlying ports, the officers being empowered to order vessels tied up when their crew becomes contumacious, the trust paying the owners of vessels so tied up all losses resulting from the delay. It does not appear that there is to be any attempt to break down the unions, but simply to meet their representatives to settle trouble if practicable, and, if not, to fight with all the power of the trust. This will undoubtedly bring about a more complete federation of the unions, and will very likely be satisfactory to all parties. It has long been the opinion of some labor leaders in this country that something of this kind applied to other industries was desirable.

The tests that the government has made of armor plates appear to have demonstrated pretty conclusively the superiority of steel containing a small percentage of nickel. We suppose it is the proper thing to determine what is best for the purpose of protecting war ships, and to use it; but in the meantime there may be other lessons to be learned from these tests. If this nickel-steel will stand the most hammering from big guns, may it not be superior for some industrial purposes? There ought some good to come from the money expended in punching to pieces ten-inch steel plates with six and eight-inch shot!

It is said that within a month or two several of the New York dailies will have in use a new type-setting machine, for which great claims are made. The machine makes the type as the work progresses. Operating a key-board makes the impression into which the metal is cast. A good deal of attention has been given during the past ten years to perfecting machines for setting type, but so far the success has not been very pronounced.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(399) F. S., Buffalo, N. Y., asks: In the case of low water in the boiler what would be the first thing to do—turn on the water at once, or bank the fires? *A.*—Cover the fires so they will give out no more heat. Turning on the water would be dangerous.

(400) E. F. R., ——, writes: I have a small upright boiler 2 feet high and 14 inches diameter; fire-box, 12 inches diameter and 12 inches high. The boiler contains 10 tubes 2 inches diameter and 12 inches long. Please tell me how large a boat it will run; also give size of engine and screw. *A.*—Length of boat, 16 feet; breadth, 4 feet 6 inches'; engine, 1¾×2½ inches; diameter of propeller, 10 inches; pitch, 18 inches.

(401) S. & P., ——, write: Please let me know what will remove the scale in our boiler; it is an eight-horse Baxter boiler. Will kerosene oil answer for the purpose? If so, how much should I use? *A.*—Use about half a pint of kerosene oil per day, and blow the water down to two gauges every week, and the entire contents every month. Kerosene oil and rubber packing do not agree, hence, if rubber packing is used for the water glass tubes replace it by asbestos wicking dipped in boiled oil, and then squeeze dry for packing.

(402) C. M., Yonkers, N. Y., writes: In the American Machinist I happened to see an article on setting engine beds, in which it is said that a metal which will expand in cooling is poured under the bed. Please give the name of the metal used, or the date of the paper. *A.*—We do not remember of having published such an article in our columns, but we have given an alloy which will expand in cooling, and which is sometimes used for filling small defects in iron castings. It is composed of 9 parts of lead, 2 parts of antimony, and 1 part of bismuth. This alloy will be too expensive for setting engine beds.

(403) H. W. M., Chester, Pa., writes: In answer to Question 392, in your issue of October 2, I notice what appears to me a mistake. Referring to Question 47, the distance from fulcrum to disk center is 4 inches, and the weight is placed 20 inches from the center of disk; this will make 24 inches from center of weight to center of fulcrum, as is indicated by the letter L in diagram. Now in equation (5) the value of L is taken as 20 inches instead of 24 inches, making a difference of 18.85 pounds in the answer, or, the weight should have been 94.3 pounds instead of 113.15 pounds? *A.*—You are right. We thank you for drawing attention to the mistake.

(404) J. F. F., Cleveland, Ohio, writes: Kindly let me know if I can turn brass and iron on a wood turning lathe by attaching a slide rest to it? *A.*—You will be able to turn small articles of brass, and probably a few small articles of iron, provided that for the latter you can reduce the speed sufficiently, and that the lathe is a good one. 2. Please give me a method for melting brass in a small ladle without a brass furnace? *A.*—To melt brass in a ladle is a very unsatisfactory way of doing it, because the ladle is liable to burn out before the brass is melted. If it is necessary to melt a small quantity of brass without placing it in the furnace, we should advise you to procure a small crucible, and melt the brass in it over a blacksmith's fire.

(405) C. P. W., Chicago, Ill., writes: We note in your reply to your Silver Springs correspondent (August 7th), that you figure 15 square feet of heating surface to the horse-power for launch boilers. Don't you think that this belongs to the day when 15 pounds boiler pressure was the maximum? *A.*—In the question referred to we were simply asked to state the horse-power of a boiler; and on account of the meager data given, we adopted the customary, though very unsatisfactory rule, of estimating the power by the heating surface. We are well aware that some builders only allow 7 square feet, others 10, 12 and 15 square feet per horse-power; we adopted 15 square feet, which we generally use in making a rough estimate of the horse-power of a boiler. If we had to design a boiler for a certain engine, we should not follow the foregoing rule, under any circumstances, but should design the boiler according to the rules given in answer to Question 246, in our issue of June 13, 1889.

(406) F. P. F., Denver, Col., writes: Please give me a rule for finding the atmospheric pressures at different elevations. I wish to ascertain how high I can raise water with a pump at elevations from 5,000 to 12,000 feet. *A.*—At the sea level the pressure of the air is 14.7 pounds per square inch; at ¼ of a mile above the sea level it is 14.02 pounds; at ½ mile, 13.33; at ¾ mile, 12.66; at 1 mile, 12.02; at 1¼ mile, 11.42; at 1½ mile, 10.88, and at 2 miles, 9.80 pounds per square inch. For a rough approximation we may assume that the pressure decreases ½ pound per square inch for every 1,000 feet of ascent. The weight of water also decreases, but the decrease is so slight that for practical purposes we may assume the weight of water to remain the same at all elevations at which a pump can be placed. For finding the height through which water can be raised, divide the air pressure per square inch by the weight of a column of water 1 foot high and 1 inch square, which is usually taken at .434 pounds. Hence, if the height through which a pump can raise water at an elevation of 1½ miles is to be ascertained, we divide 10.88 by .434 and obtain $\frac{10.88}{.434} = 25.07$ feet. In this, allowance must be made for an imperfect vacuum in the pump, leaks, etc., which may reduce the height to 20 or 22 feet.

(407) B. K., Cedar Rapids, Ia., writes: Please answer the following questions as fully as space in your valuable paper will allow, and thereby greatly oblige a young reader. 1. What are the duties of a mechanical engineer? *A.*—The duties of a mechanical engineer are to design all kinds of machinery, and to superintend the construction of the same, when required to do so. In superintending work, it is the duty of the engineer not to err on the side of unreasonable strictness, or that of improper leniency, so as not to involve those who employ his professional services in loss or annoyance. And above all, it is the duty of the engineer to hold his professional honor above suspicion. 2. What are the duties of an electrical engineer? *A.*—As the name implies, it is his duty to design, and, when necessary, to superintend the construction of machines and appliances used in connection with electricity. The duties of the electrical and mechanical engineer are the same, with the exception that the former devotes his professional career to the study of electricity and machines connected with it, while the latter devotes his professional career to machines and structures outside of electricity. 3. How much salary do they receive? *A.*—That depends on circumstances and the ability of the engineer. There are engineers whose career has been crowned with wealth and reputation, and there are others who have disappointment and poverty as their constant and unwelcomed companions. 4. To become a first-class electrical engineer, is it necessary to study mechanical engineering? *A.*—Yes, but not to so great an extent as when mechanical engineering is to be followed as a profession. 5. Which is the best way to pursue to learn electrical engineering? *A.*—Go to college; or if circumstances will not permit it, engage the services of a private tutor, or attend some evening school, and study at home.

(408) M. H. A., Lavaca County, Texas, writes: My boiler is 8 feet long, 36 inches diameter; it contains 22 flues, and is rated at 15 horse-power. We first got up steam on the 18th of October, 1889. On the 27th of June, 1890, three of the flues commenced leaking. We took them out and found two holes in each flue with specks all along the flues, as shown on the piece of flue which I have sent to you. The holes and specks were all on the top of flues, the other parts of the flues were all right; no specks and no holes, only on top. We have never used any water except rain water caught from roof of millhouse into an underground cistern in millhouse. The cistern is cemented; it has been in use two years, and has been emptied once and cleaned out. You will note that the piece of tube which I have sent to you is from the end of flue, but this was only a matter of convenience in cutting. The flues were affected in the middle just the same as at the ends. The inside of boiler is not near as bad as the flues. Boiler flues were new when put up. All the flues are affected with the specks. The boiler was used but once a week, and then with an average pressure of only 45 pounds. Flues were always kept covered with water. Please answer the following questions: Is the water used (rain water) the cause of these holes, or is the cause due to defects in the iron? If water is the cause, what is in the water to produce the effect? If water is the cause, can anything be put in the water to prevent the damage? *A.*—The phenomenon is a clear case of pitting, which may be caused by surface defects in the iron due to cinder spots, etc., but frequently it is due to the intense local action of fatty acids, or other particles of corrosive substances; in some cases the cause of pitting is attributed to the galvanic action of particles of heterogeneous metals. It is difficult to locate the cause of the trouble without seeing the boiler and its surroundings, but we believe that the pitting is caused by the water used. Although rain water is the purest of all natural waters, it may hold in suspension injurious substances which have been gathered on the roof and carried by the water into the cistern. It is impossible to state what these substances may be without analyzing the water, and therefore we cannot say if anything can be put in the water to neutralize the damaging effect of the injurious substances. You do not state whether the water is heated before it is fed into the boiler; if it is heated, the manner of doing so may put fatty substances into water, which will also cause pitting. Our advice is to change the water, and, before doing so, examine the boiler thoroughly to find extent of the damage done by pitting, which must be repaired before the boiler is used.

(409) R. H., Whitestone, N. Y., writes: Please inform me of the amount of water that would pass per minute through a four-inch pipe under a pressure of forty pounds? Also give me the rule for measuring the carrying capacities of pipes of various diameters under various pressures. *A.*—The discharge will depend on the length of pipe, which you have not given; we shall assume the pipe to be 2,000 feet long. The pressure you have given we suppose to be the pressure per square inch. Our first step will be to find the head of water which will produce this pressure. The head is found by multiplying the pressure in pounds per square inch by 2.304; hence, we have for the head $40 \times 2.304 = 92.16$ feet, say 92 feet. In order to find the discharge, the simplest course to pursue is first to find the velocity, for which we have the following:

$$v = \sqrt{\frac{2gh}{1 + m + f\frac{l}{d} + n}}, \quad (1)$$

which is a general formula for the velocity of flow. Here v denotes the velocity per second; g, the acceleration due to gravity; it is often taken at 32.16; for the sake of simplicity we shall take it at 32.2; h denotes the head in feet; m, the effect of the entrance head; its value is taken at .5 for a pipe whose end is flush with the side of the vessel or reservoir from which the water is discharged; f denotes the friction factor, a rough mean value, often used in approximate computation, is .02; for clean iron pipes, either smooth or coated with coal-tar varnish, and laid with close joints; l denotes the length of pipe in feet; d, the diameter in feet; and n, the effect of bends, gates, etc., in the pipe. When the pipe is straight and of uniform diameter without gates, $n = 0$; hence, for straight pipes, n is thrown out. Now, substituting for the symbols g, m, f, their values we have

$$v = \sqrt{\frac{2 \times 32.2 \times h}{1.5 + .02\frac{l}{d}}}, \quad (2)$$

which is a formula from which the velocity of water through smooth straight pipes of uniform diameter may be computed. Now, substituting in formula 2 for h, l, and d, their values as given in the example, we have

$$v = \sqrt{\frac{2 \times 32.2 \times 92}{1.5 + .02 \times \frac{2000}{.333}}} = \sqrt{\frac{5924.8}{121.62}} = 6.9$$

feet per second. This velocity would have been correct, provided the friction factor f remained the same for all pipes, but this is not the case; it decreases both when the diameter and when the velocity increases. Now looking for the velocity just found in a table of friction factors, we find that for a 4-inch pipe it should have been .023 instead of .02. Using the factor .023 in formula 2, and again calculating the velocity, we obtain 6.54 feet per second. In this manner, by one or two trials we can always find the velocity v so as to agree with the corresponding value of f. A table of these friction factors will be found in a treatise on Hydraulics by Prof. Mansfield Merriman, an excellent work treating on this subject. Having found the velocity, we can easily find the discharge, for we have only to multiply the velocity by the area of the pipe. In our example the pipe is 4 inches diameter, the corresponding area is 12.56 square inches, and reducing the velocity to inches, we have $6.54 \times 12 = 78.48$ inches; hence, the discharge per second will be $12.56 \times 78.48 = 985.7088$ cubic inches. The discharge per minute will be $985.7088 \times 60 = 59{,}142.528$ cubic inches; dividing this by 231 we obtain

$$\frac{59{,}142.528}{231} = 256 \text{ gallons}$$

per minute. This result should be regarded only as a close approximation, partly because the condition of the interior surface of the pipe greatly modifies the discharge, and partly on account of the defective theoretical knowledge regarding the laws of flow.

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MANUFACTURES

A cotton-gin and grist-mill will be erected at Sardis, Tex.

An agricultural implement factory will be erected at Cordele, Ga.

A cotton factory will, it is reported, be erected at Birmingham, Ala.

A. C. Jones, Hot Springs, Ark., will erect a $35,000 ice factory.

The erection of an electric light plant is contemplated at Darien, Ga.

The erection of a $500,000 cotton-mill is talked of, at Yazoo City, Miss.

The establishment of an ice factory at Lakeland, Florida, is talked of.

The works of the Ross Valve Company, Troy, N. Y., are being enlarged.

A cotton factory will, it is reported, be erected at Waxahachie, Texas.

W. H. Withgott is erecting a new iron and brass foundry at Easton, Md.

One of the new enterprises at St. Louis is the St. Louis Steel Foundry Co.

It is reported that a saw and file works will be established at Stanley, Va.

An electric light plant will, it is reported, be erected at Gainesville, Tex.

Henry Bay & Son will erect a 25 or 40-ton ice factory at Charleston, S. C.

A knitting and woolen-mill will probably be erected at Morristown, Tenn.

A stock company is being organized to erect a roller flour-mill in Belton, Tex.

It is stated that H. C. Sloan will establish an electric light plant at Lakeland, Fla.

The Eufaula Cotton-mills will double the capacity of its cotton-mill at Eufaula, Ala.

H. J. Mitchell, of Lehighton, Pa., will move his car-spring works to Anniston, Ala.

The Batesville Iron Works, Batesville, Ala., will add a foundry to its machine shops.

The Sweetwater Ice and Coal Co. will erect a 20-ton ice factory at Florence, Ala.

Liddell & Co. are about to build a large machine shop and foundry at Charlotte, S. C.

J. W. Garratt & Co. (St. Louis, Mo.,) are contemplating an addition to their foundry.

Ground has been broken for the Sheffield (Ala.) Foundry, Machine and Boiler Works.

It is stated that a Canada steel manufacturer will remove his plant to Atlanta, Ga.

The Kingsbury Manufacturing Company is erecting a machine shop at Beresford, Fla.

A stock company is reported as organized, to erect an ice factory at Atlanta, Texas.

Beard & Son, Greenville, S. C., will build a foundry and machine shop at Charlotte, S. C.

The Buena Vista Manufacturing Company will erect an ice factory at Buena Vista, Fla.

The Excelsior Manufacturing Company will erect an electric light plant at Washington, Ga.

The Tiffany Iron Works, at Tecumseh, Mich., has been incorporated, with a capital of $50,000.

The Enterprise Knitting-mill (Little Falls, N. Y.,) will be removed to Cohoes, N. Y., January 1.

The organization of a stock company to erect a cotton factory is projected at Gadsden, Tenn.

A movement is on foot at Parkersburgh, W. Va., looking to the establishment of a nail factory.

A stock company is said to be organizing at Johnson City, Tenn., to operate a steel rail mill.

The Lehigh Valley Spring Works, of Lehighton, Pa., are erecting branch works at Anniston, Ala.

The Sweetwater (Tenn.) Woolen-mills will, it is stated, double the capacity of their woolen-mill.

The Bluffton Car Wheel Company has been organized, to build car wheel works at Bluffton, Ala.

The Jackson Foundry Association will erect a new building for its iron foundry at Jackson, Tenn.

The Charleston Electric Light and Power Company will erect an electric light plant at Charleston, S. C.

The Greenville Water and Electric Light Company will erect an electric light plant at Greenville, Tex.

A rolling-mill for the manufacture of merchant bar-iron from scrap is being built at Fort Worth, Tex.

A syndicate has purchased the Cummings Iron Works, at Hammond, Ind., and will increase the plant.

The establishment of a co-operative iron foundry and machine shop at Durham, N. C., is contemplated.

The Coatesville Boiler Works, at South Coatesville, Pa., have been incorporated, with a capital of $50,000.

It is stated that the Lawrence Iron Works, of Ironton, Ohio, will move their rolling-mill to Glasgow, Va.

The Mt. Joy Novelty Iron Works, of Mt. Joy, Pa., will, it is stated, move its works to Frederick, Md.

It is reported that H. J. Mitchell, of Lehighton, Pa., will move his car spring works to Anniston, Ala.

A brass foundry and plumbers' supply factory will be erected at Anniston, Ala. R. H. Cobb is interested.

It is understood that the Nashua (N. H.) Iron and Steel Co. is making arrangements to start up its scrap-mill.

The American Bridge Works, at Roanoke, Va., will, it is reported, erect an addition to its works, 75x100 feet.

A steel plant is to be erected at Ironton, Ohio, by the Belfort Iron Company and the Kelley Nail and Iron Company.

It is reported that a party of New York capitalists are contemplating starting large car wheel works at Baltimore, Md.

A new plant for the manufacture of iron piping is to be erected at Bessemer, Ala., by the Howard Harrison Iron Co.

J. A. George has prepared plans for a three-story machine shop, 60x150 feet, and a foundry, 30x50 feet, at Rome, Ga.

The Waynesboro (Ga.) Electric Light Company has been incorporated by A. G. Whitehead, P. L. Corker and others.

A. E. Rice and others, Chicago, Ill., have incorporated the Rice Machinery Company, to manufacture machinery.

A contract has been let to erect a new machine shop 40x90 feet, for the Excelsior Machine Works at Wheeling, W. Va.

It is stated that an iron furnace will be built, and an iron foundry and machine-shop established, at Crawfish Springs, Ga.

The Youngstown Iron and Steel Company, of Youngstown, Ohio, has been incorporated, with a capital stock of $600,000.

It is stated that contract has been closed for the erection of an iron foundry in Wytheville, Fla., by J. E. Gill, of Raleigh, N. C.

The North Chattanooga Manufacturing Co. will erect works for the manufacture of mill machinery in North Chattanooga, Tenn.

It is stated that J. H. Gill, of Raleigh, N. C., is investigating with a view to establish foundry and machine shops at Glasgow, Va.

The Duval Engine Co., of Zanesville, Ohio, is reported as having signed contracts to move its engine works to Roanoke, Va.

The Smithdale Iron Co. have been organized by J. P. Gay and others, to build one or more iron furnaces at Lawrenceburg, Tenn.

Ten thousand dollars worth of new machinery is to be put in by Cheney Brothers, the silk manufacturers, at South Manchester, Conn.

The Swift Iron & Steel Works, of Newport, Ky., has been bought by the Ironton Steel Works Company, and will be rebuilt and enlarged.

The Titusville Electric Light Company (Titusville, Fla.,) has been organized, with a capital of $3,000, with the privilege to increase to $10,000.

Another iron furnace will, it is stated, be erected at Kensington, Ga. The Kensington Land Co., of Chattanooga, Tenn., can give information.

The Chadwick Lead Works, of Boston, are to move their litharge plant to Salem, Mass.; it will be one of the most complete in the country.

Syracuse (N. Y.) capitalists are investigating the entire plant of the Macon (Ga.) Gas Light and Water Company, with a view to purchasing.

Work has been commenced on the buildings of the South Boston Iron Works, at Middlesborough, Ky. The main building will be 1,200x150 feet.

W. W. Sprague, formerly general foreman of the Chicago, Rock Island & Pacific shops at Chicago, has started a machine shop at South Chicago, Ill.

The foundry of the Lexington Foundry and Hardware Company, Lexington, Ky., of which W. J. Houlihan is president, has been formally opened.

It is said that the Rome & Decatur Railroad Company (office, Rome, Ga.,) has purchased a site for the erection of machine shops at Decatur, Ala.

The Citizens' Electric Light and Power Company, Houston, Tex., has increased its capital stock $50,000, and contemplates enlarging its electric light plant.

The Frederick City Manufacturing and Development Co. is negotiating with a Pennsylvania company for the location of an iron foundry in Frederick, Md.

It is rumored that the Middletown Machine Company, Middletown, Ohio, very recently incorporated, will soon begin the manufacture of paper machines.

The people of Sioux Falls, South Dakota, have been asked to give $50,000 and the necessary land toward the establishment of an edge tool manufactory there.

The track bolt works of the Springfield Iron Co., Springfield, Ill., which were destroyed by fire, have been started up again. The entire plant has been remodeled.

The Herzog Manufacturing Company, of Minneapolis, Minn., will erect a two-story brick forge and machine shop, and a one-story foundry, at a total cost of $45,000.

The Curtis Regulator Company (Boston) have a new catalogue and price list of specialties, such as pressure regulators, traps, damper regulators, separators, etc.

The Billings & Spencer Co. (Hartford, Conn.,) are working up eight tons of copper per month into the Billings drop-forged and cold-pressed commutator bars for dynamos.

The Chattanooga Electric Railroad Company has secured permit, and will soon commence the erection of the plant, at Chattanooga, Tenn., to operate its road by electricity.

G. E. Wheeler and J. C. Keifer (Wilmington, Del.,) contemplate erecting a factory at Piedmont, Ala., for manufacturing a patent covering for steam pipes and boilers.

A company has been organized to erect an electric light and power plant, at Montgomery, Ala. P. B. Bibb, W. H. Gesner, C. G. Abercrombie and others are the incorporators.

Frederick C. Chase will, it is stated, organize a sub-company of the Safety Electric Light Co., of Boston, Mass., with a capital stock of $100,000, to operate in Fernandina, Fla.

The Folding Sewing Machine Company has been incorporated at Springfield, Ill., with a capital stock of $50,000. The incorporators are Marion O. Smith, Frank S. Smith, A. C. Smith.

Harry C. Sloan will erect an electric light plant at Lakeland, Fla. It is to have a capacity of 200 sixteen candle-power incandescent lamps, and four 1,200 candle-power arc lamps.

An electric light plant, capable of producing 650 incandescent and 13 arc lamps, is to be started at Springfield, Vt., if enough subscription encouragement is offered by the citizens.

The company operating the New Cumberland (W. Va.) Foundry and Machine Shops contemplate increasing its capacity by erecting a new building and putting in new machinery.

The Thomson-Houston Electric Co., of Boston, Mass., has, it is stated, received contract from the Kensington Land Co. for the erection of the electric light plant at Kensington, Ga.

The Porter Foundry and Machine Co., of Allegheny, Pa., will rebuild their shops, recently destroyed by fire. Two new wings, 60x90 and 60x70 feet respectively, will also be added.

The Norton Emery Wheel Company (Worcester, Mass.,) has issued an illustrated price list of dry rubbing and sharpening stones. These stones are made in a variety of sizes and shapes.

A board of directors has been chosen for the projected cotton-mill at Summit, Miss. A permanent organization having been effected, the establishment of the factory seems assured.

The plant erected about two years ago at Allentown, Pa., for testing Edison's process of working ore, is being removed to Ogdensburg, where the experiments and tests will be continued.

The H. Dudley Coleman Machinery Company has been incorporated at New Orleans, La., to succeed H. Dudley Coleman & Co., manufacturers of machinery, etc. The capital stock is $100,000.

M. M. Duncan, H. C. Young, C. P. Moore and others have incorporated a $200,000 stock company for the purpose of building works at Cardiff, Tenn., for the manufacture of sheet-iron and sheet-steel.

The Portsmouth Iron Machine Company, of Portsmouth, Ohio, has signed a contract for the erection of a branch boiler and machine shop at Grand Rivers, Ky., to be known as the Moore Structural Iron Works.

Work on the new five-story brick factory, to be erected by Mower Bros., on the corner of Oxford and Almont streets, Lynn, Mass., has commenced. The factory will front 45 feet on Oxford street, and 105 feet on Almont.

A $30,000 stock company has been formed for the erection of the electric light plant and ten-ton ice factory at Florence, S. C. The Florence Improvement and Manufacturing Company can give particulars.

The work of re-lining the furnace of the Burden Iron Works, Troy, N. Y., commenced last week. A Gordon-Whitwell hot-blast stove will be added, and the capacity of the furnace increased by the alterations.

The Chicago Emery Wheel Company, of Chicago, Ill., has been incorporated, to manufacture emery wheels. The concern has a capital stock of $10,000; incorporators, F. A. Schwartzenberg, F. A. Scott and others.

The Bethlehem (Pa.) Iron Company has called a meeting of its stockholders to consider a proposition to increase the capital stock from $3,000,000 to $5,000,000, the money to be spent in enlarging the company's plant.

Bradley & Co., manufacturers of steam hammers, agricultural implements, carriages, etc., Syracuse, N. Y., are about to add another acre of floor space to their immense plant, which already occupies one entire square.

The Machine Manufacturing Co., lately organized at Orange, Mass., for the purpose of manufacturing small machine tools, has leased the Bingham Steam-mill for five years, and will probably begin work during October.

F. J. Kimball, president of the Norfolk & Western Railroad Co., states that car wheel works and a large number of other enterprises will be built in Roanoke, Va., to employ in the aggregate several thousand hands.

The Edison-Sprague Electrical Supply Company is negotiating for a site in Troy, N. Y., on which to erect a plant. Efforts are being made for the site of the Co-operative Stove Works. The plant will be a branch of the main works at Schenectady.

The projected pulp-mill at Madison Bridge, Me., will be of large proportions. The contract calls for the laying of 50,000 brick per day for forty consecutive days, commencing about the middle of October and completing the building before December 1.

The Falcon Iron and Nail Co., of Niles, Ohio, will commence at once to build six new puddling furnaces at its Russia mill. The company is now building three new ones in the Falcon mill. There will also be four built at the old mill in the near future.

The foundation has been completed for the building of the Steel Truss Car Wheel Works, Edwardsville, Ill. The contract provides that the entire structure shall be completed by November 1. Part of the machinery for the plant has already arrived.

A new three-story foundry is to be erected at the shafting works of G. V. Cresson, in Haverhill, Mass. The new plant will be 150x70 feet, three stories high. It is to be built as an addition to Mr. Cresson's present foundry, and will be similar to it in construction.

The Hainsworth Steel Company, of Pittsburgh, Pa., is making good progress with the improvements and enlargements at its works. Some of the foundations for new machinery are laid, and others will be put down as rapidly as the other work about the mill will permit.

Erastus Wiman, the well-known New York capitalist, was in Woonsocket, R. I., one day last week. He is interested in a new process of manufacturing worsted knit goods, and says his company will soon erect a factory to employ 1,000 operatives.—*Journal of Commerce.*

The Richards Pulp Company, of Skowhegan, Me., is rebuilding its mill and putting on an addition, 36x48 feet. A change in the machinery is to be made, new and improved grinders being put in, and the heavy gears in the basement changed to the belt system. It will require an expenditure of $6,000.

The Lancaster Steel Roofing Company has decided to remove its plant from Lancaster, Ohio, to Duluth, Minn. The company now employs 25 men, but it is said the force will be increased to 100 men on its removal there. Roofing plates eight feet long and two feet wide are manufactured by this company.

W. Englewood confirms the reported sale of 1,075 acres of land to the Tennessee Industrial Land Company, Dayton, Tenn. The company has authorized Mr. Englewood to receive bids for the erection of an electric light plant and the construction of two iron bridges across the Cincinnati Southern Railroad.

A steel plant, it is reported, has just been located at Jacksonville, twelve miles north of Anniston, Ala., which, when complete, will employ 3,000 hands. It is placed by the Eastern syndicate at the cost of $3,000,000. The product of the plant will all be worked up by the company in other plants, located and used for that purpose.

The Moline Plow Company (Moline, Ill.,) are setting up a new bolt-heading machine, the largest of its kind in that part of the country. It has just completed a brick addition 114x46 feet to its already mammoth plant of four stories. The first floor will be used as an addition to the machine-room, and the three upper floors for warehouse.

The Salem Car and Machine Company has just been organized at Salem, Va., by capitalists from New York, Boston, Maine and New Hampshire. The authorized capital is $500,000. Work on the new plant will begin as soon as the foundation details are completed. J. W. Allemong is president, and W. U. B. Stinson, of Concord, N. H., vice-president.

The large machine shop formerly used by David W. Pond, machine tool builder, on Unwin street, Worcester, Mass., has been sold to Frederick Jeffts, of that city, who will at once utilize it for manufacturing purposes. Since Mr. Pond removed his machine works to Bloomfield, N. J., four years ago, the property has stood idle. The price paid was about $90,000.

Curtis & Curtis, of Bridgeport, Conn., manufacturers of pipe-cutting and threading machinery, for the better accommodation of their rapidly increasing business have opened a branch office at No 74 Cortlandt street, New York, where they will keep a full stock of their goods. Mr. H. H. Walker is in charge. They have issued a new and enlarged circular.

The proposed increase of the capital of the Bethlehem Iron Works from $3,000,0000 to $5,000,000 is the direct result of the development of steel industries produced by government contracts for ship armor and gun metal. The new capital is required for additional plant and ordnance works, by which armor and guns can be turned out for the government on a large scale.

It has been officially announced that an English syndicate has secured control of the Magee Furnace Company, of Chelsea, Mass., and the Smith & Anthony Stove Company, and other smaller concerns in that vicinity. The prospectus gives the name of the corporation as the American Stove and Furnace Company. It is to have a capital of £250,000 in common and prepared shares, and £125,000 in 6 per cent. mortgage bonds.

The new blast furnaces in course of erection at South Chicago are making satisfactory progress. The Illinois Steel Company expect to have two of their new stacks in operation in October, and the other two will probably be completed and put in blast by January. The Iroquois Furnace Company blast furnace is under construction, and considerable work has already been done, but it will not be completed much before the spring of 1891.—*Industrial World.*

The New York Central Iron Works Company has been formed at Geneva, N. Y., to continue the business of the firm of William B. Dunning & Co., in the manufacture of the Dunning heating boilers and other specialties. Mr. Dunning is president of the new company, but Mr. E. N. Squires will be in active charge as secretary and manager. Mr. Dunning is a veteran inventor and manufacturer of forty years' experience, and a pioneer in the application of steam to the work of heating buildings.

The name of the Chester Rolling-mill Co., of Thurlow, Pa., was, on October 1, changed to the Wellman Iron and Steel Co., and the capital stock was increased from $600,000 to $1,000,000. The increased capital is to be used in improving the works and in buying new machinery. The works cover about forty acres of ground on the Delaware River. The officers of the new company are: S. T. Wellman, president; William G. Neilson, vice president; John P. Crozer, treasurer, and Richard Peters, Jr., secretary.

The Billings & Spencer Company (Hartford, Conn.,) has issued a new and enlarged circular and price list of machinists' tools and drop forgings in copper, bronze, iron and steel. The illustrations are excellent, those of drop forgings being instructive in giving an idea of the wonderful progress in this process of fashioning metals. The frontispiece is entitled "Vulcan Surprised," and represents that worthy gazing in undisguised astonishment at a row of drop hammers turning out work in a way he never dreamed of.

The Leavitt Machine Company has been organized at Orange, Mass., with these officers: President, Warren M. King; secretary and treasurer, G. E. Bates; directors, J. B. Forley, Warren M. King, Thomas E. Leavitt, G. E. Bates. The company has rented the G. W. Bingham factory, and is having it equipped with new machinery. It will employ about forty men, and run a general machine shop. Thomas E. Leavitt will be superintendent and general manager. Mr. Leavitt has been foreman at the R. Hunt machine shops the past ten years.

The firm of William Cramp & Sons will, in future be known as William Cramp, Sons & Co. Within a very few days several prominent New Yorkers have obtained control of a very considerable portion of the stock of the Philadelphia firm. Standard oil interests are represented among the new stockholders. This is the first time, so far as is known, that there has been any stock of the establishment held outside the Cramp family. According to the agreement drawn up, the members of the Cramp family will fill all the offices of the company during the next five years.

There is water-works agitation in Kansas City, Mo.; Huntington, L. I.; Greeley Center, Neb.; Morristown, Tenn.; Oenaville, Tex.; Fort Wayne, Ind.; Lowell, Mass.; Conway, Ark.; Troy, N. Y.; Flatonia, Tex.; Mason, Tex.; Stanley, Va.; Elizabeth, Pa.; Greenville, Tex.; Northampton, Mass.; Huntington, N. Y.; Elwood, Ind.; Hamilton, Mass.; Henderson, Minn.; Eddy, Tex.; Hardwick, Vt.; Breckenridge, Tex.; Milford, Mass.; Arkadelphia, Ark.; Eustis, Fla.; Babylon, N. Y.; Topeka, Kan.; Greenville, S. C.; Adairsville, Ga.; Cincinnati, O.; Tacoma, Wash.; Centralia, Wash.; Manchester, N. H.; Jacksonville, Fla.

Doings at Backaway.

Mr. Editor:

A change has come over Backaway since I wrote you about some of the peculiar characteristics of Johnson. The G. & I. Company has got a new superintendent. Jones had been superintendent ever since the works were built. Jones was not only superintendent, but he was everything else connected with the company's business at Backaway. He was chief engineer, first machinist, foreman *ex-officio* of every room, general purchasing agent and—without specifying further—he was all there was of the company in a general view of the case, and was selected for the position because he was the only man who knew *all* there was about the whole matter, from beginning to end, as it were. When any repairs were to be made, Jones not only superintended their doing, but he did the greater part of the work. A half dozen mechanics would stand around in a condition of profound awe, while Jones drove keys, adjusted set-screws, laced belts, and put things right generally. Things had to be right, and who but himself could Jones trust to make them so? And what would become of Jones' prerogatives, if some one else decided just how hard a set-screw should be turned home? I was engineer by title—got my name in the directory as such—but that didn't mislead one of the six thousand inhabitants of Backaway. They knew Jones hired my fireman, told him how to fire, bought all my supplies, bossed all my repairs, figured out the kind of coal to burn, tied, with his own hands, strings around all the water glasses to indicate the exact water level—Jones did all these things, and many others, letting me help him to keep things straight, if I didn't try to help too much.

One day he showed me how to start the engine. Said I wasted too much steam in the operation. Never ought to take more than five seconds to get her right down to regulator speed. He knocked a cylinder head out in showing me, but bless you that wasn't his fault. The fireman had let the water get a full quarter of an inch above the string in one of the boilers! We fixed up the engine, and Jones discharged the fireman. Nothing of that kind would go with Jones.

I have only hinted at how Jones helped things along. I couldn't tell half of it, if I tried. And what he did for me, he did for every man in the works. There was never any doubt that Jones was the busiest man around the place.

Backaway is a small town, as towns go, and everybody knew what Jones did at the mill. Not a man in the town believed that the G. & I. works could continue in operation without Jones. How could works like these be run without a head that knew everything about their operations?

What wonder that, with all this strain on him, Jones should wear out fast? Who could manage a business requiring a dozen classes of skilled workmen, furnishing the brains for all of them, without wearing out? But the strange thing about it is his men wore out. I mean the men who would have been held responsible for the conducting of departments, but for the interposition of Jones in their favor. Somehow these men didn't seem to get along easily; seemed to worry over their work, and pass out broken down; sometimes they couldn't seem to suit their work to his plans. Of course it was their fault. All they had to do, was to wait for him to come around, and tell them what to do—come around and discharge three or four men, and set things working.

The particular line of manufacture in which the G. & I. is engaged, had been for years without much competition. The company made the prices, and that was about all there was of it. But finally competition got stronger, and eventually the product of the plant failed to pay operating expenses, and give the stockholders interest on their investments. Of course this was no fault of Jones. Heaven knows that he attended to the smallest detail, and no one worked so hard as he.

As things got worse, Jones redoubled his efforts; nothing was bought in the way of supplies that was not absolutely necessary at the moment; nothing was spent in repairs until a breakdown occurred, and then Jones did more of the work of fixing up than ever. A foreman who ventured to suggest that a new machine costing as much as four hundred dollars would accomplish a large saving, was incontinently discharged. Of course the company couldn't afford to buy new machines when it was losing money. Where were the dividends to come from if this was done?

Jones worked harder than ever, but strangely enough, things went from bad to worse. Some good orders were lost because Jones was so busy at the mill he couldn't look after them. Finally these things so worried him that he broke down; broke down completely, and was forced to retire.

As I have intimated, there was not a man in Backaway that thought the works could be run without Jones. When a man had worked sixteen hours a day in his efforts to keep things going—worked sixteen hours a day, and slept every night with a pad, pencil and light by his side, to capture every ghost of a thought—what chance had an ordinary man to even rattle around respectably in his place? When a man like Jones, who knew everything about ten or fifteen trades, and personally ran every branch of the works, had come at last to be unable to make the business pay expenses, what could a man who didn't know much about any trade do?

There wasn't any one in Backaway that thought there were any hopes for the G. & I., except, possibly, two or three new directors who had just come to have a hand in the management.

Jones, quite done for, left, and the directors—what else could they do—in a desperate effort to do *something* hired a new superintendent, a Mr. Smeaton.

Smeaton knew a good deal, in a general way, about the work done in such a mill, but there were a good many things he didn't know. He couldn't forge a key, or fit and drive it after it was forged. And there were a dozen men in the mill that he couldn't tell anything to speak of about their business. Jones knew all about these things. When he split the big pulley driving the key, everyone understood it was because he knew just how a key ought to be driven to hold. And what other man in the mill would dared to have driven it with a twenty-pound sledge? Jones knew all about these things, and had failed, what hopes that Smeaton should succeed?

Smeaton took hold Monday morning, and it was Wednesday before I had more than a glance at him. Jones used to interview me in the engine-room six or seven times a day.

But Wednesday a messenger boy (something unknown under the dispensation of Jones) came to me with word that the superintendent requested my presence in his office. This was something new, and probably meant trouble for me; probably it meant a discharge. I had attended to things alone around the engine and boilers for three days, and something might have gone wrong. I went to his office, and Smeaton politely asked me to sit down.

"Well, Oldone," said he, "how is everything going in your department?"

This was the first intimation I ever had that I had a department, but I replied as well as I could. You see the fact was that some little repairs were needed, and I was packing the rods with some ancient and rather dirty hemp, because Jones had decided the company couldn't afford to buy packing when it was losing money. I ventured, on the strength of the new superintendent's amiability, to suggest that I was using my rods rather badly with the antiquated packing, and to ask if I could have something different. He referred me to a clerk, who, he said, would order whatever I required in that line.

"What kind of packing shall I get?" I inquired.

Smeaton's eyebrows took an upward turn; he looked vexed. "Oldone," said he, "how long have you been running that engine?"

"Ever since it was put in," I replied.

"Then," said he, "if you don't know what kind of packing to order you have missed your vocation."

I ordered the packing, and didn't see anything of Smeaton again for a week. Then he came into the engine-room, looked around for a few minutes, passed into the boiler-room, and finally came back and sat down. In the course of a few minutes' talk he managed to find out that I had learned the machinists' trade, worked at it for some years, and finally abandoned it for engine running, because it paid better. Finally he inquired, in an innocent sort of way, what power the engine was developing.

I bought an indicator while we had the old engine, and as the new one came provided for attaching it I had put it on soon after starting it. But Jones had no faith in indicators, and discouraged its use. Still I had found out enough to give, as a pretty fair estimate, 300 horse-power. Then he asked if the engine would stand fifty horse-power more; he was going to put machinery in the west bay, which had remained empty ever since the mill was built.

Yes, the engine would stand it, but we were short of boiler power now; we would be obliged to increase that.

The boilers were nearly new, made to work under 110 pounds pressure, but rather limited in capacity.

Then came the inquiry: "How much coal do you burn?"

Jones never saw the necessity for weighing coal, so I couldn't answer the question. I hadn't the means for weighing coal, even if I had had some curiosity in the matter.

The new super. walked across the floor two or three times, and finally stopped short. "Oldone," said he, "I have taken hold of this job to make money for the stockholders, and incidentally I am going to make it pleasant and reasonably profitable for us all. Your position hereafter will be that of Chief Engineer, and when I say that, I mean all the title implies. As chief engineer I shall hold you responsible for the condition of all the machinery in the mill. You will take charge of the machine shop, and you will order, through my clerk, all supplies for your department. I expect you to run your department in the best interests of the company, and I expect to be relieved of all care in the matter.

"You will need an assistant, whom you must find. Of course I shall be willing to consult with you at any time, but I shall expect you to furnish the brains for your department. When I think you are not doing the best that can be done I shall let you know without unnecessary delay. I shall not fetter you in any way, but shall be glad to help you. I want to know general results—no details."

I took my honors meekly as possible, and Smeaton, after a minute's study, continued: "The next meeting of the directors will occur in four weeks, and just in the way of advice I would, if I were you, make the closest estimates I could of the cost of throwing out the present engine and putting in a compound, accompanying this estimate with the probable saving by doing so. This estimate I will present to the directors, signed by you as chief engineer."

I was a little dazed at the idea of throwing out that engine, that had been the pride of Jones, and had made so many faithful turns; but Smeaton immediately left, giving me no chance to speak on the subject. I find it is a characteristic of his to go away when he is through talking.

The next day I ordered scales, and began weighing coal, and brushed up my indicator, and began to determine what the power was costing the company.

Without going further into details, I found we were using 315 horse-power, and burning 10,630 pounds of coal per day. With the added 50 horse-power we should burn about 12 000 pounds, costing $21.

Then I must find what it would cost to put in a compound engine. I visited three engine and boiler works, and estimated cost of erection. With the added power on the old engine another boiler would be required, while with the new engine the present boiler capacity would be ample, and from the best estimates I could make (I forgot to say that Smeaton advised—that was the way he put it—never to estimate in my own favor), I concluded the change would cost the company $9,000.

When it came to the saving in fuel the case was not so clear. Builders seemed willing to give almost any kind of a guarantee, 1½ pounds being the favorite. In my despair—for I thought I knew this to be too small—I went to see Johnson, whom you will remember my writing about being at the new mill with the 800 horse-power compound. Johnson listened to my story, then he took a book out of his desk, and showed that he was running on 1¾ pounds. "But," said he, "your engine is to be smaller than mine and you can't run on so little coal. You can," he continued, "find any number of experts that will demonstrate by scientific tests that you ought to run on 1½ pounds, but ordinary mortals like you and I can't do anything of the kind. We can't have fifty-dollar-a-day assistants; and there are lots of things in a scientific test of an engine that we are not up to. We don't know how to make the necessary 'deductions' to come out right

"My advice," said he, "Oldone, is to add just 30 per cent. to the best 'guarantees' offered, and go ahead feeling reasonably certain."

I took his advice, and figured that the coal consumption with the proposed compound would be two pounds per horse-power per hour, making, say, 7,500 pounds per day, costing $13. This would represent a saving of $2,400 a year, and would pay interest at the rate of 25 per cent. on the investment. Putting the statement into the best shape I could, I signed it and handed it to the superintendent. I don't know whether or not I shall get the new engine; I know the figures astonished me.

Joel Oldone.

What the Grumbler Said.

The grumbler had a talk with an American Machinist item-gatherer the other day, and he made out a rather strong case. He put it like this: "If a man goes to a railroad station to take a train, or to meet incoming friends, and finds the train late, he knows how much late the train is without serious delay. He finds the latest information on this point posted in conspicuous letters before his eyes, reads it, and governs his actions in accordance with the knowledge thus obtained. If this information were not conspicuously posted, or freely given, a general howl would go up from every patron of the road, increased in the chorus by every station lounger. Even men of deep moral convictions would get dangerously near the border line of profanity in their use of expletives. Now," he continued, "I have been waiting from seven till ten this morning for a relative who is on a steamboat plying the Hudson river. No one knew when the boat would arrive. There were a good many waiting under similar circumstances, yet there were no denunciations of the steamboat company. Waiting without knowing seemed to come as a matter of course. These same men, waiting at a railroad station under the same conditions, would have painted the surrounding atmosphere a decided blue."

When the grumbler ceased, the item-gatherer ventured to suggest that there was an important difference between railroading and running steamboats on the rivers of the country. The railroads had wires through which information could be given without much trouble.

"What is the matter," retorted the grumbler, "with steamboat companies using the wires? If a boat is on time she will pass a town or city at about such an hour. In that town or city is a telegraph operator who would, for a small consideration, notify the terminal landing, or other places at which she might make landings, of her passage, or of the fact that she was late. Then this news could be bulletined the same as at railroad stations, to the great advantage and peace of mind of those in waiting."

The item-gatherer gave up the argument, acknowledging that the grumbler had the best of it.

According to *Glaser's Annalen*, delta metal is a very old alloy, having been known to the old Egyptians. It was first prepared, however, in a scientific manner by Alexander Dick, a German, in 1882. This metal is an alloy of copper, iron and zinc, resembling aich-metal and sterro-metal, which contain the same elements, and are largely used for heavy guns. The delta metal is prepared by taking advantage of the fact that melted zinc will dissolve about nine per cent. of its weight of iron. The saturation point of the zinc depends upon the temperature of the metals during the process—the higher the temperature the greater the amount of iron absorbed. At a white heat nearly 20 per cent. is taken up. The fluid alloy is then mixed with an amount of copper or copper and tin, which varies according to the purpose for which the metal is intended. The oxides present are removed by the addition of a small quantity of manganese, usually in the form of copper manganese alloy.

A case of considerable interest to railway employes comes off shortly in Lahore. An engine driver, whose eyesight has been injured by an accident while on duty, brings an action against the Northwestern Railway for compensation. His claim is that the injury was caused by the bursting of a gauge-glass, owing to the carelessness of those servants of the company who were responsible for the serviceable condition of the machinery on the complainant's engine, and that in consequence of his injury he is incapacitated for life for railway service. He therefore lays a claim for the pay of twenty-five years' service, which, but for the accident, he would have been qualified to render to the railway. Calculated on this basis, the claim amounts to 30,000 rupees.—London *Engineering*.

A simple and economical way of tarring sheet-iron pipes to keep them from rusting is as follows: The sections as made should be coated with a coal tar and then filled with light wood shavings, and the latter set on fire. It is declared that the effect of this treatment will be to render the iron practically proof against rust for an indefinite period, rendering future painting unnecessary. It is important that the iron should not be made too hot, or kept too hot for too long a time, lest the tar should be burned off. Hence the direction for the use of light shavings instead of any other means of heating.—*Iron*.

Mr. W. W. Snow, of the Ramapo Wheel and Foundry Co., has found by extended experiment that an addition of about 3 to 5 per cent. of manganese to ordinary pig-metal produces a soft and ductile metal; and that an increase of the manganese to from 8 to 10 per cent. greatly hardens the product, and imparts great toughness and durability under friction and abrasion. Mr. Snow proposes to use this metal for brake shoes, and has secured a patent on a shoe made of this material, in which the proportion of manganese may range from 5 to 15 per cent. of the amount of the iron.—*Railway Master Mechanic*.

A contemporary, in speaking of the gas gun invented by M. Giffard, alludes to the possibility that we may have some day a "Giffard liquefied engine." There are, no doubt, many engines running in this country to-day that ought to be liquefied by passing them through the cupola, but for the purposes to which an engine is usually devoted, we should think that a liquefied engine would be something of a failure.

In Minnesota it has been decided by the higher court that the upper berths of sleeping cars must be closed when not in use.

Machinists' Supplies and Iron.

New York, October 11, 1890.

Iron—American Pig—No new feature of importance has developed during the week, consumers not supplied on contracts buying only to cover their immediate wants. Production has exceeded the demand somewhat, though not to a sufficient extent to affect prices or cause disturbance. Values are without quotable change.

We quote No. 1 Foundry standard Northern brands, $17 to $18; No. 2, $16 to $16.50; Southern brands No. 1 Foundry, $16 to $17; No. 2, $15.75 to $16.

Scotch Pig—Labor disturbances are affecting production, which has been considerably reduced, though this has had no very marked effect upon the market here.

We quote Coltness, $25.50; Dalmellington, $22; Eglinton, $20.50.

Bar Iron—There has been a noticeable improvement in the demand, and this has resulted in a firmer feeling, though prices are not quotably higher.

We quote Common, $1.85; Medium, $1.90; Refined, $1.95 to $2.00 for round lots on dock.

Plates—The market has continued easier, and concessions have been made by dealers which amount to a reduction of prices, though quotations cannot be said to be lower.

We quote Common Tank, $2.25 to $2.30; Refined, $2.35 to $2.45; Shell, $2.35 to $2.45; Flange, $3.40 to $3.45; Extra Flange, $3.60 to $3.75.

Lead—The market continues to rule in sellers' favor, supplies for prompt delivery being very difficult to obtain. Small lots have been sold at 5.75c. to 5.80c.

Spelter—Consumption has been rapidly increasing, and supplies have become closely restricted, in consequence of which there has been a sharp advance in values, especially for Western.

We quote ordinary brands of Western at 5.90c. to 6.00c.; choice, 6.00c. to 6.10c.; refined, 6.75c. to 7c.; Silesian, 7⅜c. to 7½c.

Tin—The market has been very much unsettled, prices fluctuating rapidly and violently both here and in London. The actual trading here has, however, been small, and the market dull. Prices for prompt delivery are about 23½c. to 24c, depending upon quality.

Antimony—There has been no change of importance during the week.

We quote Hallett's at 20c.; L. X., 22c.; Cookson's, 22c.

Copper—It is reported that very large contracts have been made between the Lake companies and large consumers, by which the production of Lake will be pretty closely absorbed up to the end of the year. The price is given at 17c. Here occasional small lots can be had at slightly lower figures.

Common casting brands are 14½c.; Arizona, 15¼c. to 15¾c.

Lard Oil—The demand has been moderate, and prices for prime maintained at 51c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Three good machinists for new work and repairs. Frank Harlow, Waterloo, N. Y.

Wanted—Six practical experienced iron moulders. For further information address Haxtun Steam Heater Co., Kewanee, Ill.

Wanted—Situation as foreman, by machinist and draftsman; technical graduate; eight years' experience. Address Box 82, American Machinist.

Experienced mechanical draftsman, with shop experience and technical education, wants situation. Address Box 87, American Machinist.

Wanted—Two or three first-class general machinists; also one who can act as foreman. Address Competent, care of American Machinist.

Wanted—Position as foreman by machinist and draftsman, practically trained and up to the times. Address Box 90, American Machinist.

French engineer, 27; not talking English well, acquainted with general drafting, and thoroughly comp. with woolen-mill mach'y (having been sup't), wants position for light salary. Box 91, Am. Mach.

Machinists Wanted—First-class floor hands and fitters of large experience and of good habits can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, O.

Wanted—Machinists for general and tool work; also trip and drop-hammer men; steady employment. William Deering & Co, Clybourn and Fullerton avenues, Chicago, Ill.

Wanted—A prac. and exp'd man for foreman in a foundry working 10 or 12 molders; work, architectural work and gen. jobbing, connected with a gen. jobbing mach. shop. General Jobber, Am. Mach.

Wanted—By a first-class machinist, a position as foreman of machine department; first-class tool hand; understands handling men and doing work quick. Address Box 89, American Machinist.

Wanted—Foreman for a machine shop in a Western city; must be posted on Corliss engines and able to manage men. A first-class man will find this a first-class position. Address Box 84, American Machinist.

Wanted—A man familiar with the designing and manufacturing of presses and other tools for the use of sheet-metal workers. State age, experience, references, and compensation desired. Address Punch and Shear Maker, American Machinist.

Wanted—Draftsman and designer; a first-class man acquainted with our class of work; also a second man as assistant, a technical graduate with two or three years' experience. Address Fitchburg Machine Works, Fitchburg, Mass.

Wanted—A situation as superintendent of a boiler shop, by a practical and energetic man under 40, who understands all kinds of boiler work; capable of taking entire charge of large shop, and willing to have compensation based on results; good references. Address Advance, American Machinist.

Position Wanted—By prac. foundryman, familiar with all details in the production of soft, light and medium weight gray iron castings; 25 years' exp. in management of foundries employing from 10 to 100 men; American, midde age, strictly temperate; unquestionable references furnished. Castings, Lock Box 433, East Brookfield, Worcester Co., Mass.

Superintendent—A member of the A. S. M. E. now in charge of an iron works employing 300 hands, desires to make a change before the end of the present year. Specialty, fine interchangeable machine and tool work, together with good designs and systematic shop management and accounts. Address Box 80, American Machinist.

Wanted—A first-class foundry foreman in Atlanta, Ga.; a man who thoroughly understands management of men, mixture of metals and general foundry work; first-class wages will be paid; none need apply who are not thoroughly competent in every respect, as their incompetency would be soon known, and would be a loss to them and ourselves. Address, with reference, Box 259, Atlanta, Ga

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BEST HAMMERS IN THE WORLD RUN BY BELT
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Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and Men fully employed. Send for Catalogue and Prices.
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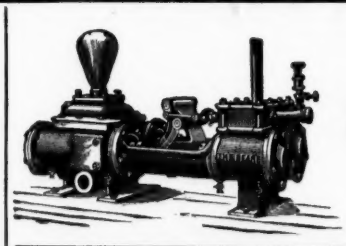

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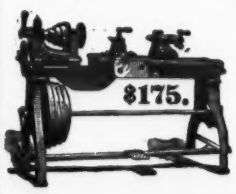

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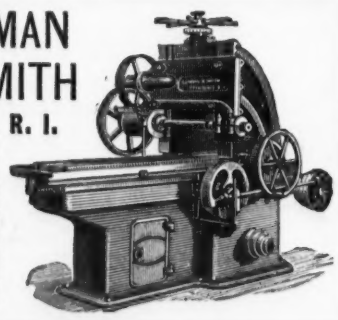

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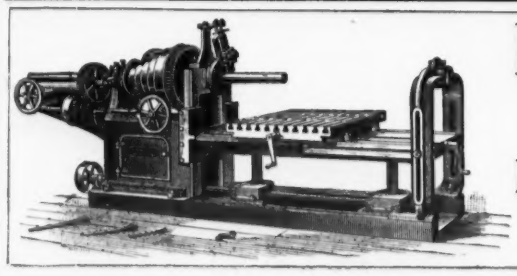

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New Designs and Patterns.

Situation as superintendent or foreman of machine shop, by a mechanical engineer of undoubted ability, thoroughly understanding modern methods of turning out interchangeable work cheaply; best references. Address Practical, AM. MACHINIST.

Wanted—Position as superintendent by machinist and tool maker; 20 years' exp.; accustomed to handle men; will be prepared to take position at end of present year; state number of hands in employ, the class of work, what will be expected of, and salary to the right man. BOX 92, AM. MACHINIST.

Wanted—First-class machinist to take full charge of shop employing 25 men; must be well up on press and die work, and thoroughly understand the handling of men and shop management; would prefer a young man who could take interest enough to identify himself financially with a good paying business. Address at once, giving full particulars as to experience, ability, wages, etc., Toledo Machine and Tool Works, Toledo, O.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d-hd lathes & planers. S M York, Clev'd, O.

Koopman's Scales for quick measurements.

Wanted—1,000 agents. See adv., p. 14. Randall.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

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For Sale—One gear molding machine (new). Stilwell & Bierce Mfg. Co., Dayton, Ohio.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

For Sale—Cheap, one 1½-inch Schlenker Bolt Cutter. Address Capitol Mfg. Co., Chicago, Ill.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—Medium-sized special machine or tool to manufacture under royalty, by machine works, Philadelphia. Address Box 88, AM. MACHINIST.

Well located foundry and general repair shops for sale cheap, owing to death of proprietor. Address Helen Woodworth, Admin., Nunda, N. Y.

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For Sale—Bound volumes of the Patent Office Gazette for years 1883, 1884, 1885, 1886, 1887 and 1888. Price, $4 per year. Address J. C., care of AMERICAN MACHINIST.

Wanted—To buy second-hand lathes, planers and shapers of all sizes. Must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

Wanted—Engineers to write for Catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

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Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular.

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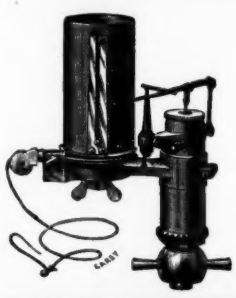

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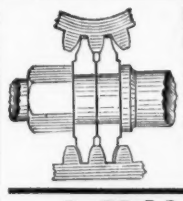

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OVER 2400 IN USE.
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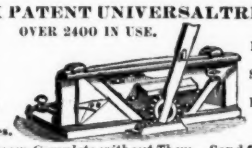

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No.	Inch.	Price.
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4	3-4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.95
10	1 1-2	.95
11	1 3-4	1.10
12	2	1.20
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	3.25
Full set of 19		$25.50
20 (ext.)	5 1-2	4.00
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This Dog has a Very Heavy Rose, so that if the thread wears, a Heavier Screw Can be substituted.

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With Steel Screws, Lathe Made and Hardened.
When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

One Small Set of 8—by 1-4 inches to 20 inch, - - $ 6.25
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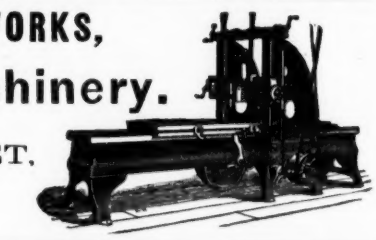

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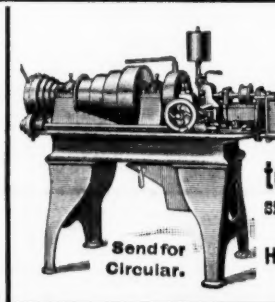

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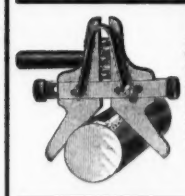

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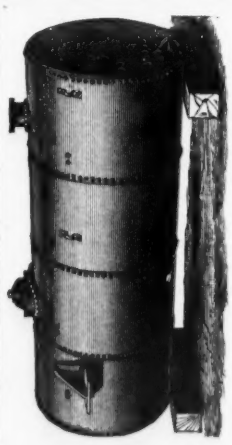

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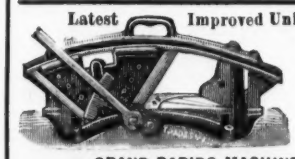

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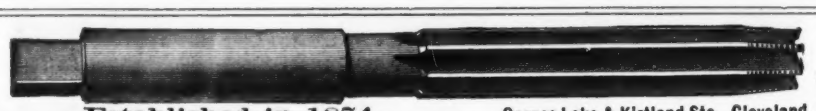

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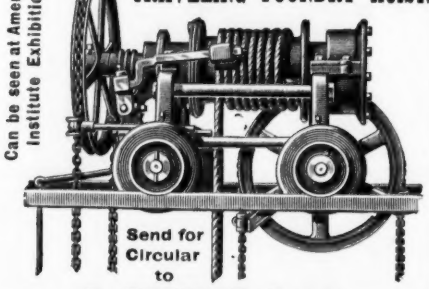
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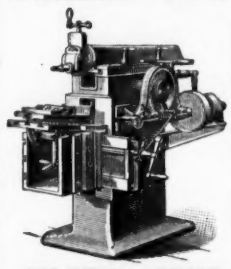
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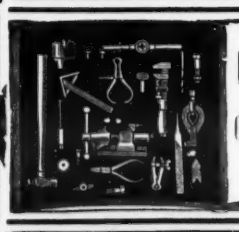
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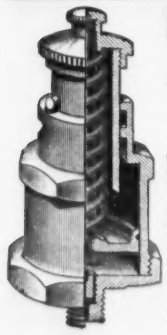
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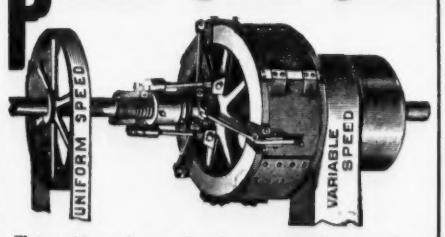

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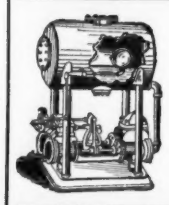
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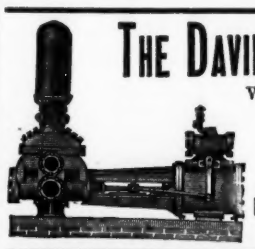
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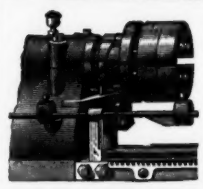
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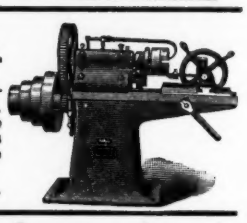

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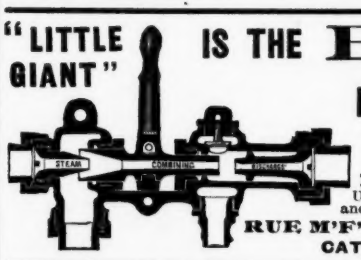

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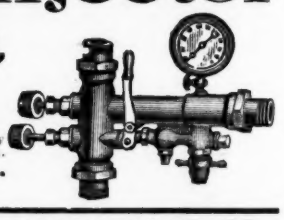

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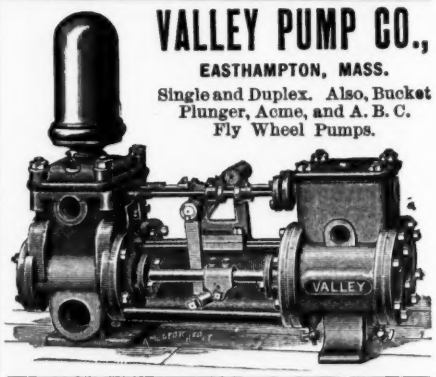

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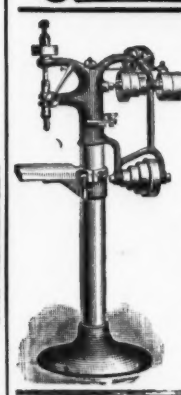
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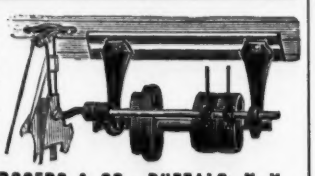
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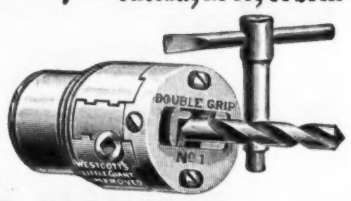

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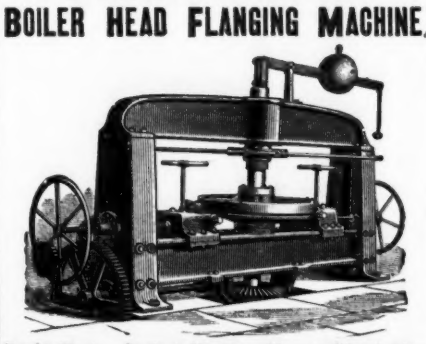

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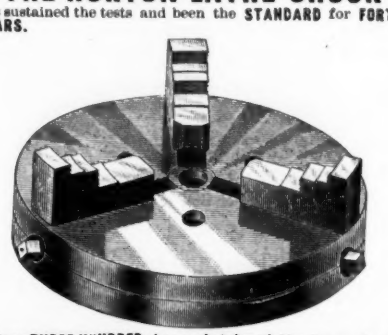

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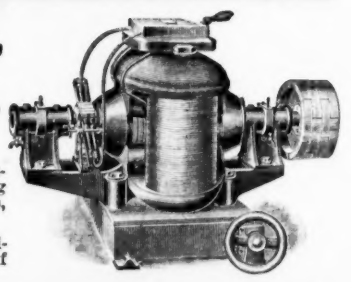

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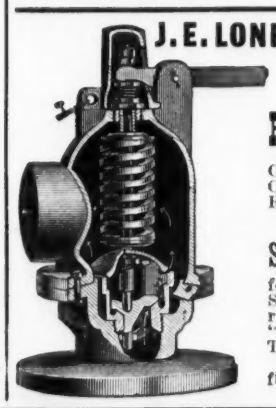

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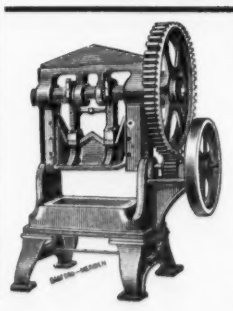

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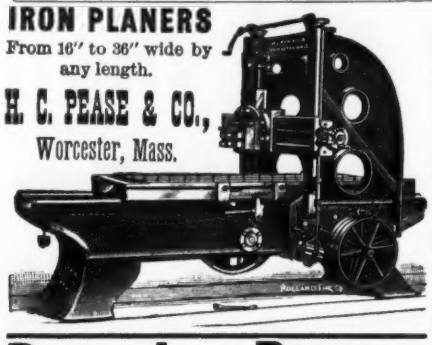

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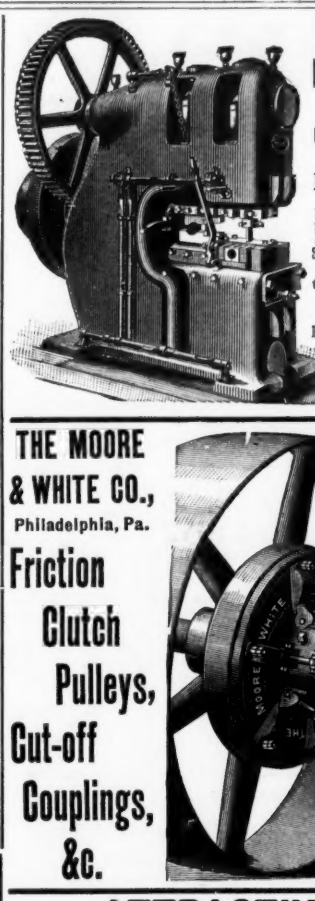

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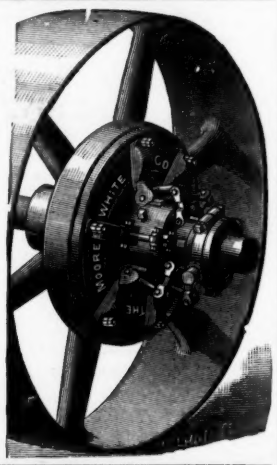

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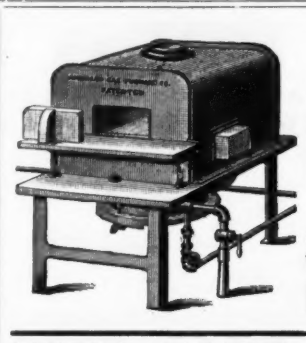

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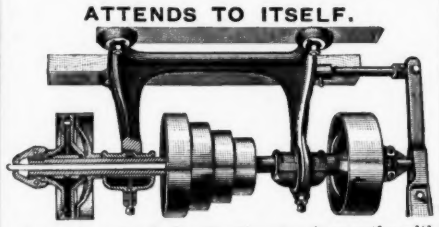

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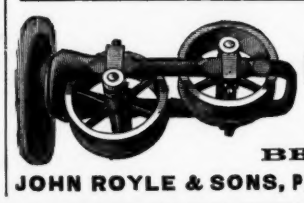

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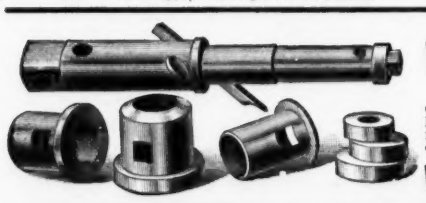

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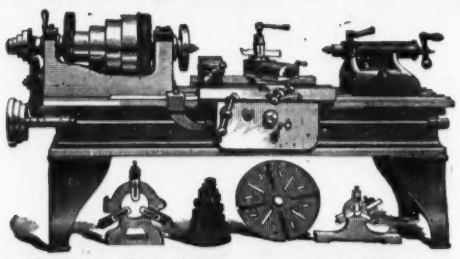

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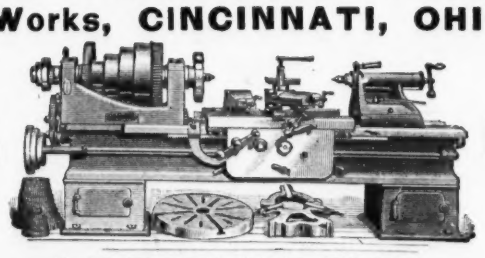

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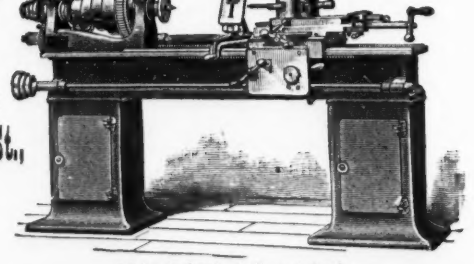

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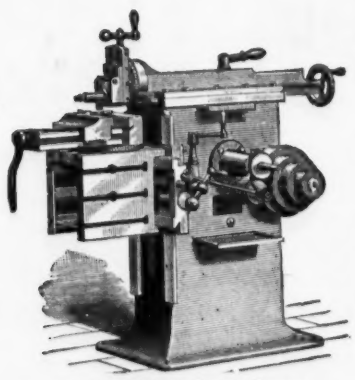

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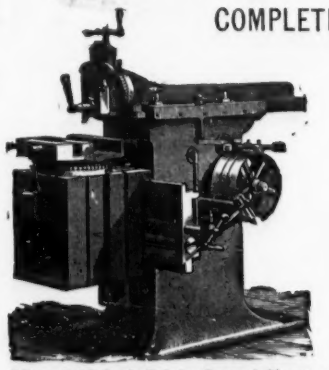

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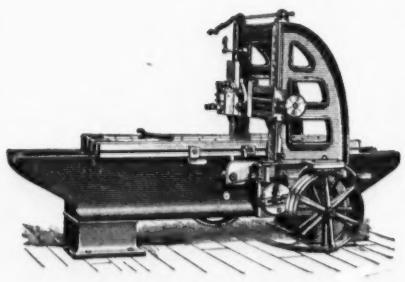

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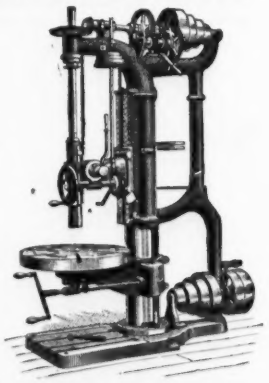

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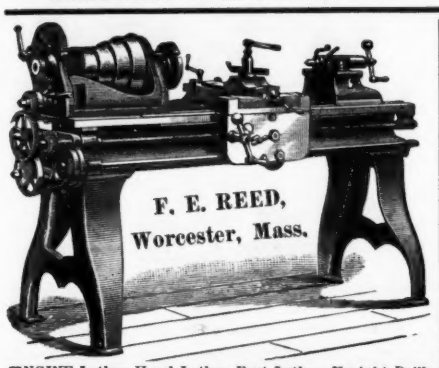

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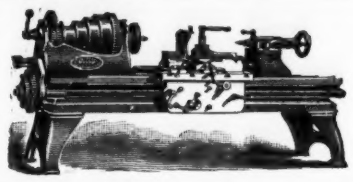

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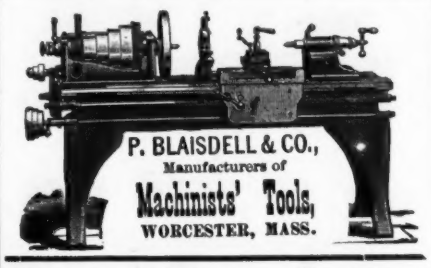

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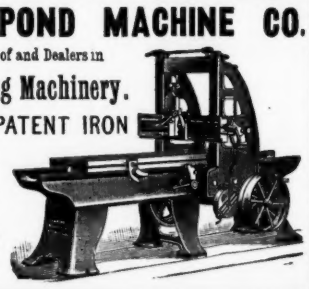

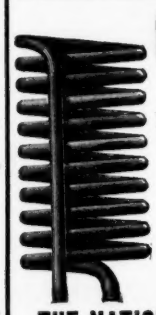

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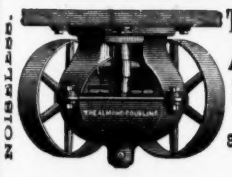

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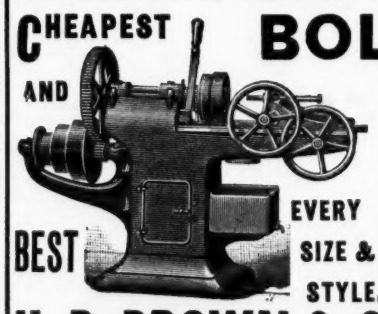

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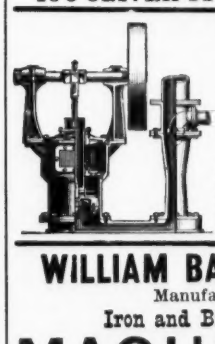

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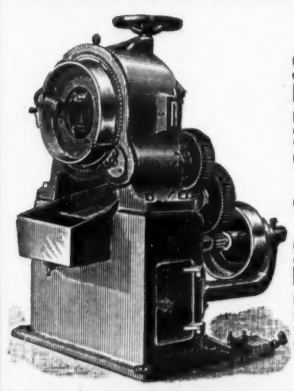

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66 CARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES

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Manufacturers of
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MACHINERY,
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Near Culvert,
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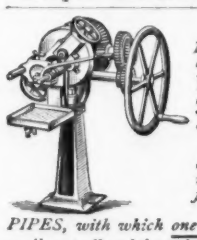
Send for Circulars and Prices.

"Eclipse" Hand Pipe-Cutting Machines.



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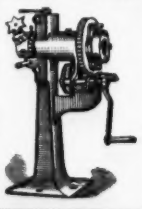

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ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
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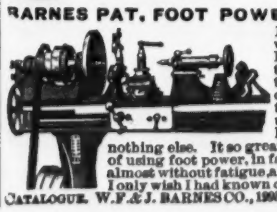

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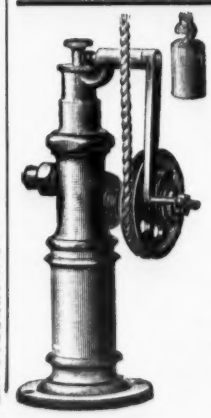

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Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
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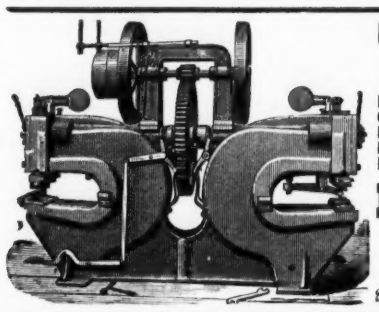
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OVER 300 SIZES.
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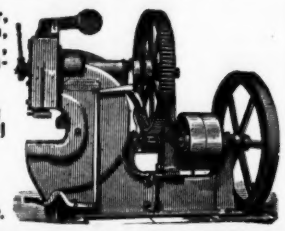

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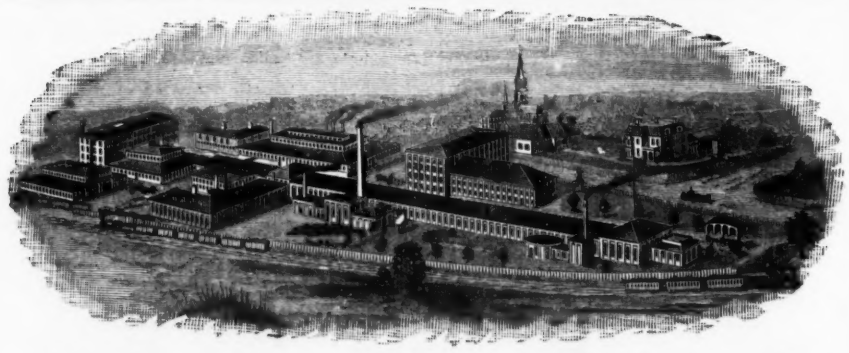
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PROVIDENCE, R.I.
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DESIGNER & BUILDER OF THE FAMOUS
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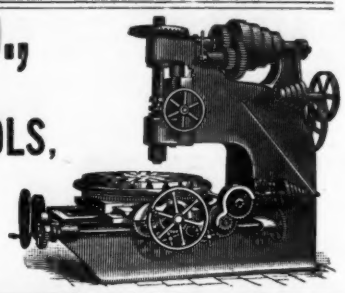

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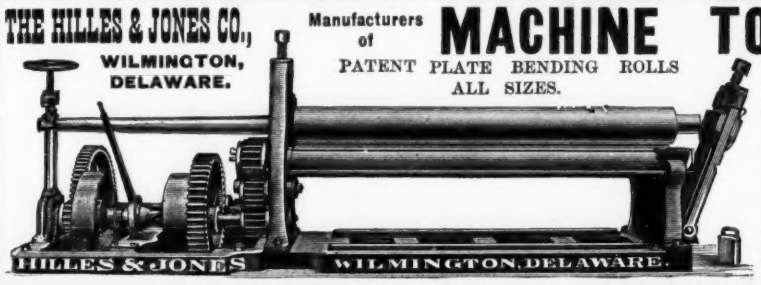

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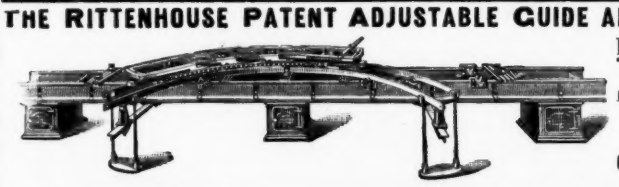
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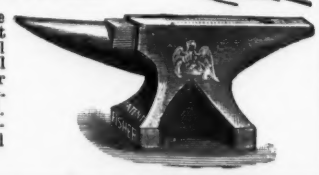
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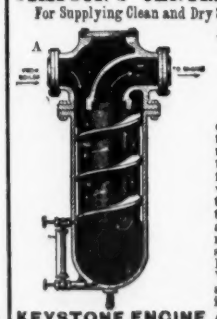

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For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or top, as convenience may require; also used in conveying steam long distances, for Steam Hammers and Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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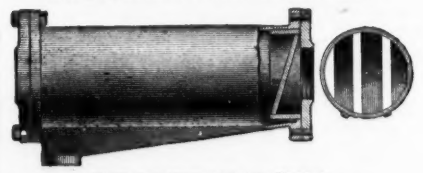
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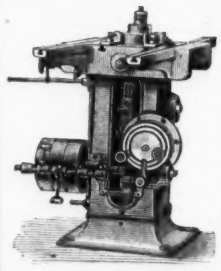
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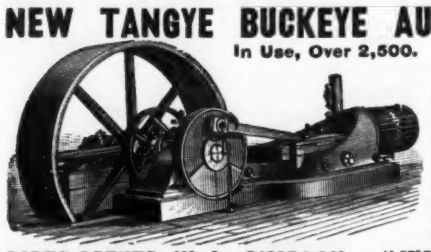

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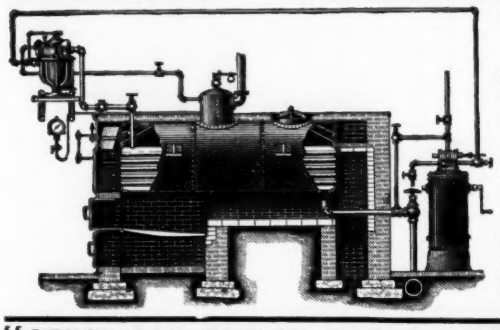

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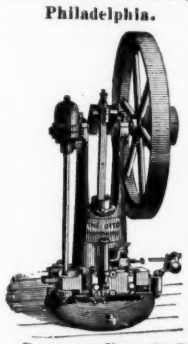

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Sensitive, Radial, Portable and Wall Drills.		
Engine Lathes, 14 in. x 6 ft., 18 in. x 6-8-10 ft.	Hendey,	new.
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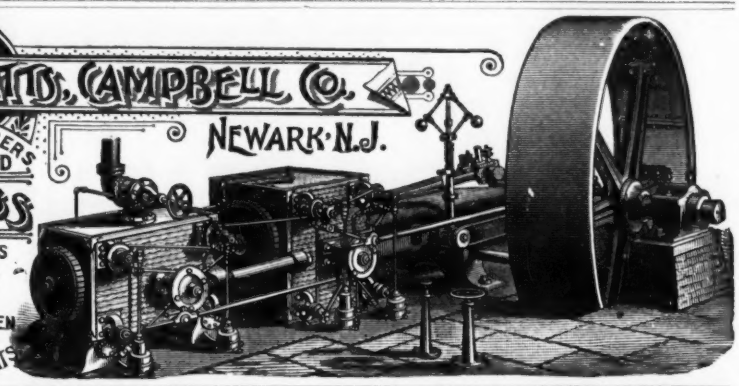

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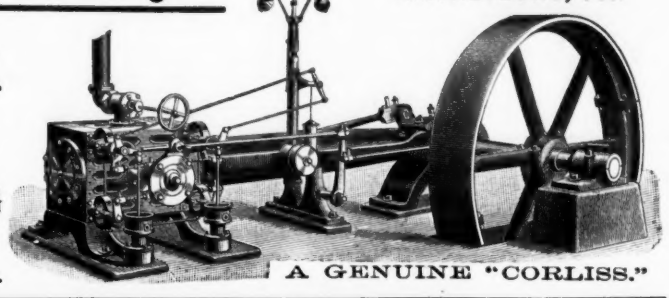

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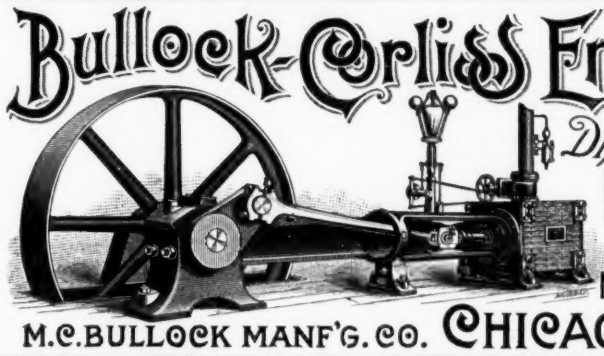

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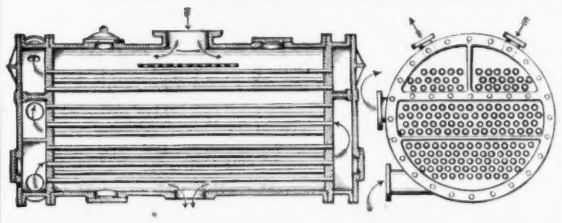

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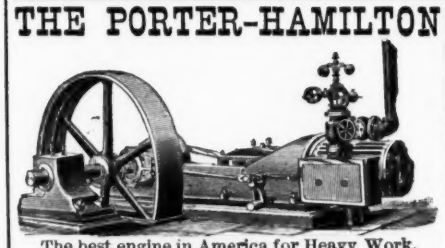

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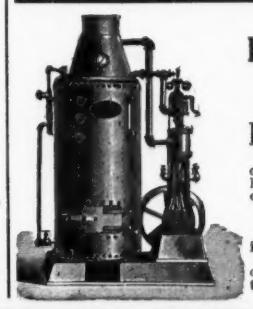

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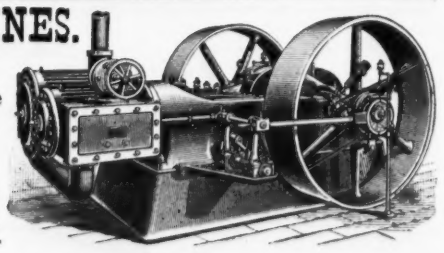

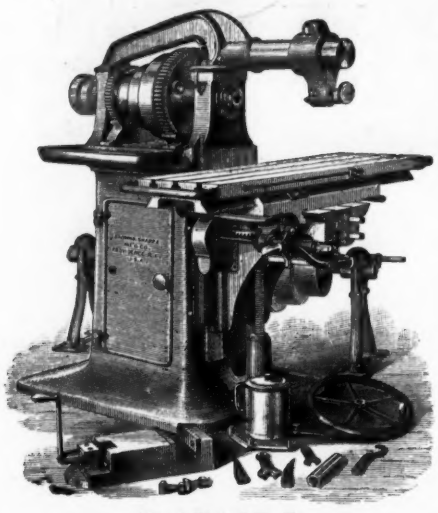

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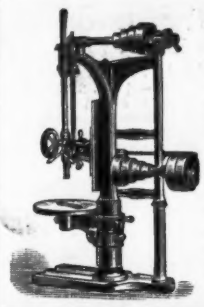

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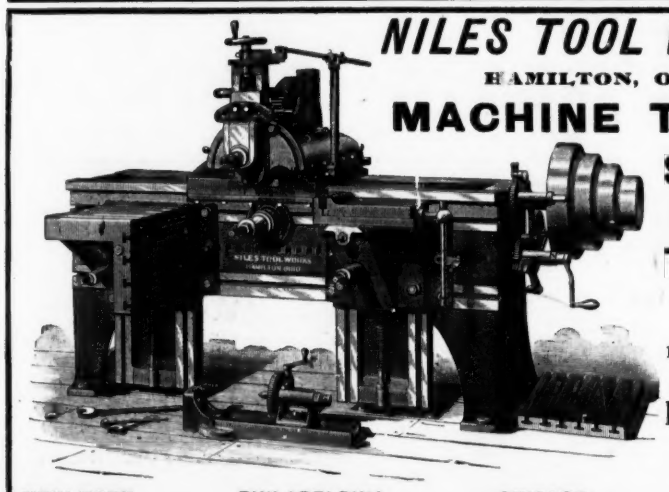

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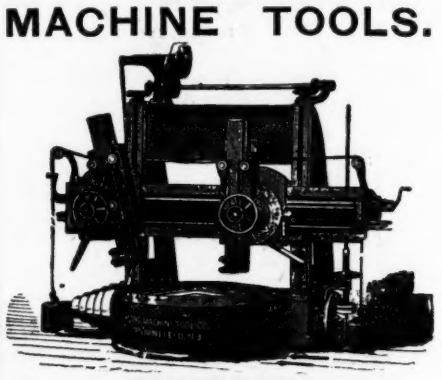

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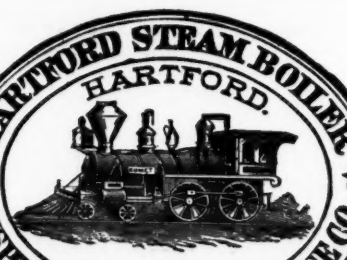

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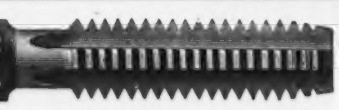

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